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IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resultant given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

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THROUGH THE BACK DOORS OF FRANCE

A Seven Weeks' Voyage in a Canadian Canoe from St. Malo, Through Brittany and the Château Country, to Paris *

BY MELVILLE CHATER

AUTHOR OF "THE LAND OF THE STALKING DEATH" AND "EAST OF CONSTANTINOPLE," IN THE NATIONAL GEOGRAPHIC MAGAZINE

THERE are two ways of seeing Europe—through its front doors and through its back doors.

The first includes trains de luxe, bustling capitals, big hotels, and personally conducting guides; and the national front-door steps are scrubbed to a whiteness for your anticipated arrival.

The second leads you, by unfrequented paths, past the back doors of family life and native customs. Nobody knows you're coming, so you get the potluck and warm welcome accorded to an unexpected guest.

The back-doors voyager, whose patron saint is Robert Louis Stevenson, has a confirmed preference for doing it afoot or astride a donkey or a bicycle; but my companion and I, who wanted to see the back doors of Brittany and Touraine, decided against these time-honored modes of travel. We ordered a Canadian canoe through a London firm and wrote the French ministry for permission to navigate the rivers and canals of western France.

When we turned up at London, three months later, the canoe had arrived, but not the permit.

"Your application," explained the representative of a French touring bureau, "is doubtless reposing under the elbow of an official at Paris. It will be my pleasure to remove that elbow."

And after another month of letters, telegrams, and kindred humerus-stirring methods, we received a *permis de circulation* authorizing the free passage of "le canoë canadien, *Nageoma,*" drawing so many centimeters of water and so many "of air," across French inland waterways.

"We don't know much about French rivers," we told the touring-bureau gentleman. "Which point of departure would you advise?"

He pondered for a moment.

"La Rance!" he exclaimed with a sunny smile, "an inlet leading from St. Malo to the canal, you know. It's very simple. You just launch your canoe at the *avant-port,* turn to the left, and there you are!"

LANDING AT ST. MALO, IN BRITTANY

It sounded like A, B, C. That night we took the Channel boat from Southampton, and the following afternoon we sighted the coastline of Brittany.

Wide, wet sands where red-capped fishermen mend their nets, a tangle of narrow streets atop a fortified rock whose

* See also "Through the Heart of England in a Canadian Canoe," by R. J. Evans, in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1922.

Photograph by Emil P. Albrecht

ST. MALO, WHERE THE CANOE TRIP BEGAN

The towers of Grande-Porte, the city walls, the crowded houses, and the tall cathedral spire of the old channel fortress make a beautiful picture. At this port, the meeting place of ocean and channel tides, the difference between high and low water sometimes amounts during the equinoxes to nearly 50 feet.

turreted ramparts are grim with an age-long beating back of the sea and sea-borne invaders—that is St. Malo.

And something of this aloof grimness burns in the Breton's eyes. For centuries his ancestors breathed gray mists and watched the gray seas for the approach of enemy ships. Quite reasonably, then, he has a dourness and a suspiciousness of nature which sharply distinguish him from the light-hearted inlander, secure in sunny vineyards.

Just as every American town has its National House and every English town its Royal Arms, so every French town has its Hotel de l'Univers. But St. Malo goes even further than that. Said the *maître d'hôtel* to whom we applied for rooms, "The Univers is full just now, but we can accommodate Monsieur and Madame in the Annex of the Univers!"

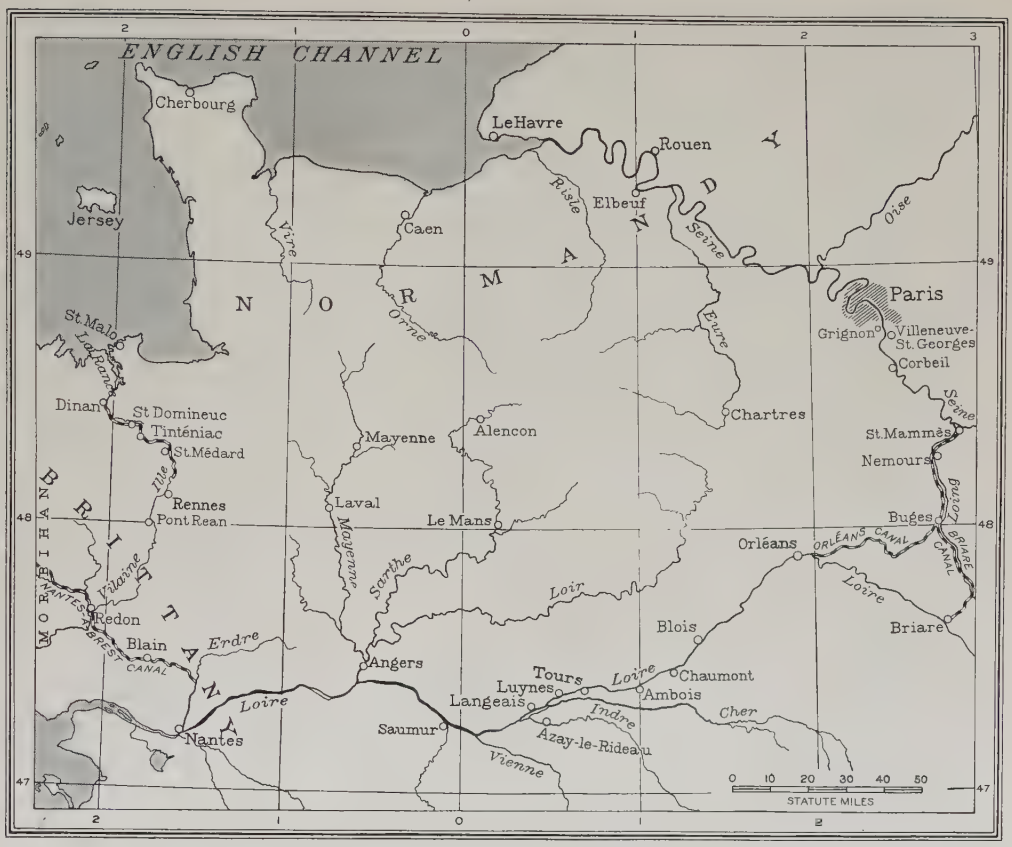
THE CANOE AND CAMPING EQUIPMENT

Next morning we went to the custom-house, where we found half a dozen Breton boatmen scratching their heads about the opened crate which contained our canoe.

The *Nageoma* was 16 feet in length. For camping purposes, it had been fitted with removable iron rods that supported a canvas awning with side and end flaps which could either be rolled up or hooked down along the gunwale, according to the weather (see illustration, page 6). It was equally simple to set up rods and canvas on the canoe or on the ground—an arrangement which afforded us, whether afloat or ashore, a rain-proof shelter 16 feet long by 3 feet wide.

Our equipment, consisting of army blankets, ground sheets, a water tank, a miniature field-kitchen, and even the nucleus of a library, was packed in duffel bags, which could be stored in the canoe and thus transported with it by rail or cart, whenever a carry was necessary.

That the thing in the crate was rudderless, motorless, sailless, without oarlocks or keel, and yet unmistakably some kind of craft, was what seemed to be puzzling the boatmen. They asked us what we



Drawn by A. H. Bumstead

THE ROUTE OF THE "NAGEOMA" THROUGH THE BACK DOORS OF FRANCE

Beginning at St. Malo, the seven weeks' journey included visits to Dinan, Rennes, Redon, Blain, Nantes, Angers, Langeais, Luynes, Tours, Ambois, Chaumont, Blois, Orléans, Buges, Nemours, St. Mammès, Corbeil, and Paris.

were going to do with it, and we replied that we were going to Paris in it. And when they had finished echoing "To Paris!", we explained, "By canal."

Then they comprehended at once; we were going to hire a donkey to tow us along the bank. But we shook our heads and showed them the paddles.

"Eight hundred kilometers by arm!" they protested. "But, M'sieu and Madame, there is a railroad!"

"Yes," we admitted, "but we prefer to do it *this* way."

Then the inspector examined our passports, so as to establish the nationality of our lunacy, and made out a receipt for the duties, which would be refunded if we exported the canoe and its contents within a specified period.

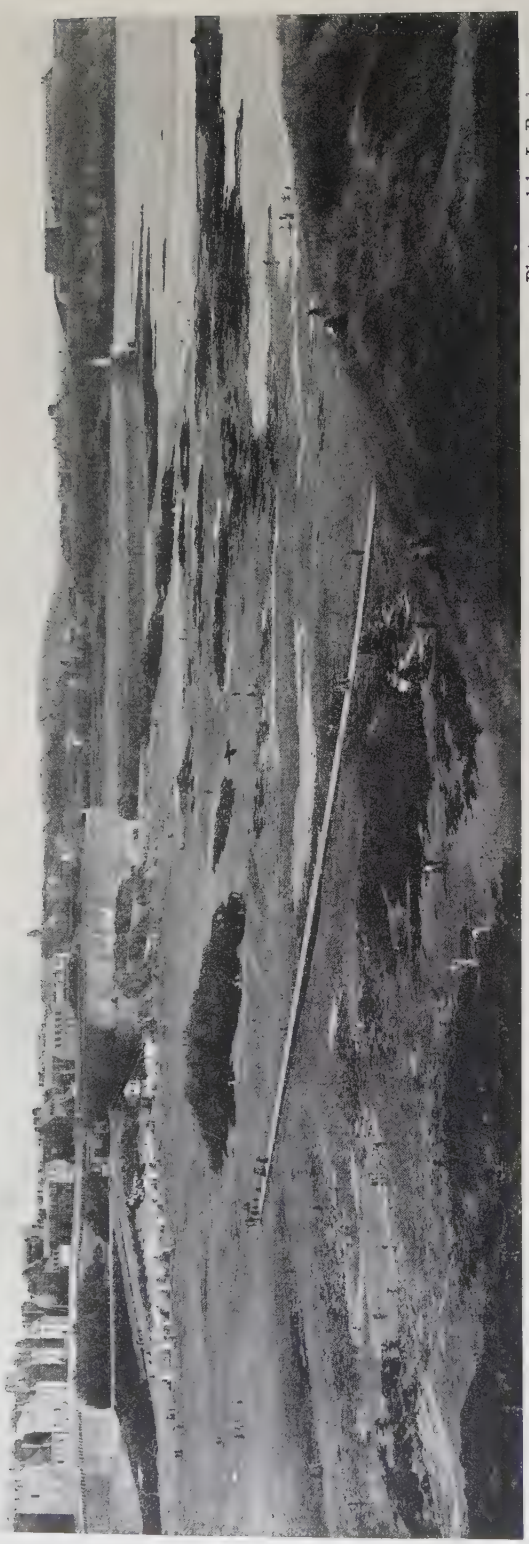
"To Paris?" he queried, as if to shake us from our resolve. And "To Paris!" we firmly replied.

For an instant he studied our muscular systems; then he said gallantly, "I will make your papers good for one year."

But to the last, I think he suspected that we had a pocket-motor concealed somewhere about us.

We carted the *Nageoma* across the town, attended by an ever-augmenting audience. Fishermen left their nets, and bakers their ovens, and *gendarmes* quitted their posts, and shrieking children dragged their nurses after them to swell our train. Certainly no battleship was ever launched amid more enthusiasm. But the faces of those knowing old Breton sailors gathered on the quay displayed less of an enthusiasm than a kind of morbid curiosity.

"There is a strong current in the Rance!" one of them called after us, as we headed across the harbor toward the low-banked stream which would lead us to the Ille-et-Rance Canal. But we only



Photograph by L. Boulanger

ST. MALO, WITH ITS ENCIRCLING 16TH CENTURY RAMPARTS AND THE BEACH OF THE GRAND BEY

The beautiful Bay of St. Malo is dotted with numerous fortified islets, one of which is Grand Bey, to which it is possible to walk dryshod from the mainland when the tide is out. The tomb of Chateaubriand is on Grand Bey. Jacques Cartier, discoverer of the St. Lawrence River, was also a native of St. Malo.

waved a cheery farewell, confident of what our tourist-bureau friend in London had told us — that La Rance was simplicity itself; that you just turned to the left and there you were. And in fact an innocent-looking stream it appeared — a winding, tree-crowned stretch of placid water not a thousand yards wide and, as our maps informed us, 22 kilometers in length. Nor was there even a noticeable current. What everybody had neglected to explain was the existence of a tremendous ocean tide.

That night the placid "stream" suddenly yawned into a rocky chasm, where the water dropped so swiftly that before one could say "Tide!" we found ourselves aground on precipitous crags.

What with the pitch darkness and the dangerous footing, before we could unload and relaunch our heavily burdened canoe, La Rance had laid bare another 20 yards of declivitous rocks. There was nothing for it, then, but to wait. So, perched aloft there among the oozy seaweed, we held on for six black hours until, at sunrise, La Rance returned from the nethermost depths and floated us off.

By noon we found ourselves gliding along

Photograph by Emil P. Albrecht

THE OLD GOTHIC BRIDGE ACROSS THE RANCE BELOW DINAN

THE "NAGEOMA" STRANDED AT LOW TIDE ON THE RANCE (SEE TEXT, PAGE 4)

Photographs by Melville Chater

FLOATING ALONG THE ILLE-ET-RANCE CANAL

The equipment for the seven weeks' voyage on the rivers and canals from St. Malo to Paris included a 16-foot Canadian canoe, a canvas awning, army blankets, a miniature field-kitchen, and the "nucleus of a library" (see text, page 2).

PASSING THROUGH A DOUBLE LOCK (SEE TEXT, PAGES 10 AND 30)

Photographs by Melville Chater

A WOMAN OPENING LOCK GATES FOR THE "NAGEOMA" ON A DESCENDING LOCK

At the first lock the author's canoe narrowly escaped disaster when the lock-keepers turned on the sluices full force. One hundred and thirty-five locks are required to lift a boat from St. Malo to the Seine at Paris (see map, page 3).

MEN AND WOMEN ALIKE ARE THE HEWERS OF WOOD IN BRITTANY

Photographs by C. A. Slade

ALL THREE BEYOND THE AVERAGE WORKING AGE

But universal industry is the secret of the prosperity of Brittany, as of all rural France.

Photograph by Melville Chater

DINAN AND THE ILLE-ET-RANCE CANAL

This picturesque old town, 15 miles south of St. Malo, rises on the left bank of the River Rance.

between cornfields where farmhouses and fishing smacks, curiously intermingled, lay perched above La Rance on such steep heights that we had to crane our necks in order to get a glimpse of them.

We went ashore and climbed up 30 feet in order to ascertain just why Breton farmers kept fishing smacks in their vegetable gardens. We found a man seated on a good-sized yawl, whetting a scythe, while behind a 10-foot wall his wife was hanging out fish-nets in the cornfield.

"Excuse us," we said, "but are you a fisherman or a farmer?"

"Oh, that depends on the tide," he answered. "At low sea, one farms; at high sea, one fishes. That is because at low sea there is no water at all, and at high sea there is no land." And he consulted his watch.

"You don't mean," I asked, "that this stranded old tub will ever be afloat again?"

"In about six hours, M'sieu," he answered, "six hours after there is no water at all."

A disquieting thought seized us. We rushed down the hill and leaped into the *Nageoma*. But it was already too late. Not water enough remained to float even a canoe. So we climbed the hill again to a deserted meadow, where we prepared to pass the night. Within an hour the lagoon over which we had come was a vast stretch of mud. Six hours later it was once more a wide lagoon, and the waters had climbed 30 feet and were rippling in across the meadow where we lay.

TIDE CAN OVERTAKE MAN ON HORSEBACK

Sunrise revealed La Rance washing against the 10-foot stone wall which protected the cornfield of our farmer-fisherman acquaintance, while he himself came sailing by us in his yawl, bound for St. Malo.

"You have but six hours to reach the first lock," he called to us, as we sat at our canned-goods breakfast atop a small, unsubmerged height, with the sea flowing all about us. "I advise you to hurry." And, knowing that what was sea would become dry land in three hundred and sixty minutes, we did hurry.

The tide in La Rance rises and falls from 25 to 50 feet, according to the sea-

son of the year. Low water exposes immense tracts of sand, across which one may walk dryshod—at his peril; for, once the rising tide is well under way, so I have heard Breton farmer-fishermen declare, its sweep across the flats is so rapid that a man on horseback, caught in the midst of a flat, cannot escape.

"You're just in time—very little water left!" called a voice, as we sighted the great lock which, at Le Châtelier, separates ocean from canal.

FACING DISASTER IN A LOCK

We paddled inside, the massive gates shut, inclosing us in a vault 16 feet deep; then ahead the sluices slid up with a deafening roar of inrushing waters!

The *éclusiers* (lock-keepers) had turned on both sluices at once, with full force; and the waters, falling from far above into an almost emptied lock, thundered about us like a tidal wave.

We knew well enough that, once broadside on, the canoe would immediately be dashed against the rear gates, and that our party would be over. However, we stuck to the task of holding her straight, while the waters boiled around us, lathering into a brown foam which crept over our gunwales; and now the frightened lock-keepers yelled directions to us and ran for life-preservers.

Happily, however, these were unnecessary. Inch by inch we were upbuoyed from the depths until over the edges of our masonry-lined vault—I had almost said tomb—there peered treetops, then red roofs, and at last the mild windings of a Corotesque stream, out upon whose levels we slid through the slowly opening lock-gates.

"How many more of these devil's bathtubs are there between here and Paris?" I called to the head keeper. He consulted his *Guide Officiel;* then called back cheerily:

"One hundred and thirty-four, M'sieu!"

Of course, we thought that he had misunderstood us; that he was quoting the death rate among canoeists overset per month in French canal-locks, or something of that kind. But the man insisted. Mentally we multiplied our recent experience by 134, and we didn't like the product. Then the lock-gates closed behind us, barring out the devouring ocean tides; and for a while we just sat blissfully at rest, drifting along the tranquil Ille-et-Rance Canal.

THE FRENCH ARE JUSTLY PROUD OF THEIR CANALS

Canal? The word is a libelous description of those idyllic streams which for seven weeks we followed across France. Instead of some inflexibly straight cut, imprisoned between stone embankments and suggestive of sewage, imagine sylvan windings innumerable, water lilies afloat, bank-bordering poplars a-march against the sky, and far ahead the subaqueous ghost of some woodland-embowered bridge dipped in the mirroring vista.

Such are the canals of Brittany and Touraine—sheer pieces of nature, pastoral symphonies. Old Izaak Walton would have loved their banks equally with the many sportsmen who come down from Paris for a week-end of fishing. The French are as proud of their canals as the Hollanders are of theirs, and with good reason.

Now, you may decoy a fish or dynamite him, or you may, like the canal fishermen of Brittany, employ an intermediate method. Just ahead of us on the Ille-et-Rance we espied a skiff whose sole occupant was pulling so furious a stroke that the water was lashed into foam all about him—this without his craft budging an inch. Presently we saw where the trouble lay: the idiot's anchor was down.

"Is he drunk?" I asked.

"Or is it Delsarte, or Swedish movements?" suggested my companion.

A FISH-FRIGHTENER AT WORK

Then we rounded the curve and sighted the explanation — an adjacent smack wherein a second man was turning a crank which hoisted out of the canal a big, square scoop-net filled with small fry. Then back went the net, and again the stationary oarsman lashed the water white; for he wasn't an athlete—he was a fish-frightener.

After two nights spent amid rocks and mud-flats, the humble waterside inn which we found at Dinan seemed to us to warrant a super-luxury tax at the very least.

Photograph by Crété

CLEANING GRAIN BY THE OLDEST KNOWN METHOD

The wind is still driving away the chaff on most of the farms of this northwestern corner of France, whose inhabitants cling to their quaint customs, their curious legends and superstitions.

Photograph by Crété

THE PUBLIC SQUARE IN COMFORT ON A MARKET DAY

The hamlet of Comfort, which is six miles from Douarnenez, possesses a Gothic church erected in the 15th century and remodeled during the two hundred years following. In its nave there is a quaint Wheel of Fortune, with bells to invoke the blessings of Heaven.

Photograph by Crété

A SHRINE ON THE ÎLE DE SEIN, THE SENA OF THE ROMANS

The Île de Sein is off the coast of the westernmost point of Finistère, which is the westernmost point on the European Continent. In the early days this mound of sand and rock, whose inhabitants eke out a precarious livelihood by fishing, was the chief sanctuary of the Celts.

Photograph by Crété

BRETONS OF FINISTÈRE PLAYING SKITTLES

Though the "alley" here is crudely hollowed out in the earth, skittles is related to our American tenpins and "ducks." The game is ordinarily played with nine pins set in a square upon a wooden frame, one angle of which is toward the player, who endeavors to knock down as many of the pins as possible in a throw.

Photograph by Crété

BRETONS AT THE DOUARNENEZ LAUNDRY TUB

Photograph by Crété

POINTE DU RAZ AT SUNSET

The passage between this rocky headland and the Île de Sein, five miles to the west, is among the most dangerous on the rugged coast of Brittany. The ancient prayer of the Breton mariners still serves the sailor to-day: "Help me, O God, in crossing the Raz. My boat is so small and the sea is so large."

Photograph by Crété

WOMEN ON A WHARF OF THE ÎLE DE SEIN

The social life of this little island clusters around its wharves and the two wells which supply the inhabitants with fresh water. The poetic Breton Angelus is still sung in its little church. The Druids left in stones a brief story of their life here, and Breton guides point out the submerged towers of the mysterious Ville d'Ys, the legend of which the composer Debussy has set to music under the title of "The Submerged Cathedral."

Photograph by Crété

A BRETON INNKEEPER

The Bretons are a simple, conservative, fearless, and independent Celtic people. Their native tongue is akin to the Welsh, and in many places in the interior French is not understood.

Photograph by Crété

A YOUNG LADY OF PLOUÉGAT-MOYSAN

Near her town is the chapel of St. Laurent-du-Pouldour, where on one night in August pilgrims make a circuit of the churchyard on their knees and bathe in a fountain as a preventive against rheumatism.

Photograph by Crété

HARVESTING FURZE NEAR PLOUGASNOU

This spiny evergreen shrub with tiny yellow flowers is found throughout western Europe, usually growing on otherwise barren heaths. In Brittany, as in other parts of France, it is used for fuel, while the tender shoots make good forage. The furze harvesters pack the shrub in mounds similar to our haystacks.

Photograph by Crété

PUTTING THE WEDDING KETTLES ON TO BOIL

There is no gayer festival in Brittany than a wedding celebration, sometimes as many as 1,800 persons being invited to a marriage feast. Often the tables are set in a horseshoe in a broad, green meadow, and the guests are served from a "field kitchen," the proud chief cook having borrowed for the occasion all the pots from the neighboring villages.

Photograph by Crété

WOMEN AND CHILDREN OF PLOUGASTEL

Just across the Elorn from Brest lies Plougastel, the market garden of Brest and of Paris, whose inhabitants have preserved their ancient costumes with few evidences of modern influence.

Photograph by Crété

BRETON WOMEN MAKING HEADDRESSES

The headdress of a Breton woman is one of the most distinctive features of her costume. She always keeps it freshly starched, and no matter how hard it rains in that rainy country of hers, she manages to arrive at the end of a journey with every crimp in her cap just where it should be.

Photograph by Crété

THE BRENN ROCK ON THE ROAD FROM SAINT-POL-DE-LÉON TO PLOUESCAT

The road running from Saint-Pol to Plouescat, on the way to Brest, passes through some of the most primitive country in Brittany and is bordered by not less than 30 curious crosses and wayside shrines.

Photograph by Crété

KNITTING SOCKS FOR FATHER AT ROCHEFORT-EN-TERRE, IN MORBIHAN

Since the landscape painter Pelouse brought the country around Rochefort-en-Terre into vogue, it has been the center of an ever-growing artist colony. Its commanding position above the river Arz and its château ruins furnish fascinating subjects for pencil and brush.

IN THE SHADOW OF A BRETON CATHEDRAL

Partisans of Breton peasants maintain that they are the most devout people of France and their province has been called "the land of calvaries and pardons." The five great Pardons of Brittany are among the most impressive religious festivals in Europe.

Early next morning the declivitous streets were a-clatter with high, two-wheeled pony-carts containing blue-smocked farmers and their white-capped wives, on their way up to the market place, atop the hill. And there we found them gathered, some holding baskets of eggs, others with chickens under their arms or with haltered calves beside them, and all displaying a clean, starched, Sunday-like air of ceremony.

Great bargain-buzzings and the clap of sabots resounded through the quaint streets whose fifteenth-century house-walls and carved façades befittingly framed that scene of snowy-capped old women and shovel-hatted old men, with their shrewd, kind faces of apple-red freshness. Never were such old folk as those Breton peasants—old, merely, like some seasoned vintage of "imprisoned sunshine."

SCENE OF COMBAT BETWEEN DU GUESCLIN AND THOMAS OF CANTERBURY

From his near-by pedestal Bertrand Du Guesclin, constable of France—he and his steed, armed cap-a-pie—looked down on the square where, some six hundred years before, he had overthrown Sir Thomas of Canterbury in single combat. The dispute between the gentlemen centered about the propriety of landing English troops on Breton soil.

I daresay Sir Thomas pointed out that his Celtic countrymen had been emigrating thither ever since the fifth century, and that he mentioned the protection of minorities, adding that, indeed, the name Brittany meant no more than Little Britain. And I daresay that Du Guesclin retorted with, "Take out your Celts, then. France for the Franks!"

It was a divided victory; for while Du Guesclin, whose heart lies buried under a slab in the church of St. Sauveur, expelled the English troops from Dinan, the Breton Celts remain unchanged to this day, there being no less than a million of them who speak their Welshlike tongue and whole communities which possess not a word of French.

Regretfully we paddled away from charming Dinan; nor did we see another town until, five days later, we reached Rennes, 65 kilometers distant. It was all "little country," as the French say, with here and there a cluster of red roofs, or a distant spire, or lock-keeper's house, to add their charm to that canoe-tempting stream on which no canoe had ever been.

A COLLAPSIBLE OUTFIT

We mustered our kitchen equipment, set up our canvas awning, and padded the *Nageoma's* mid-space with blankets to a thickness of several inches. This gave us a clear ten feet of lounging room and allowed three more feet at each end of the canoe for storage.

You can do much even with a rather narrow 16-foot space if you will observe the principle of mobility and collapsibility. For the sake of convenience, the *Nageoma's* middle thwart had been rendered removable. Its position was usually occupied by our camping-table—a board two feet wide, fitted to rest athwart on the gunwales.

In addition to this folding-table, we carried collapsible food-containers, a collapsible oil-stove, a folding anchor, a folding water-bucket, and folding cups and cutlery. "You don't happen to have folding hatchets, frying-pans, and flat-irons?" we had jocularly inquired of the salesman at the Collapsible Supplies, Limited, in London. And, without a smile on his stolid face, he had promptly produced the trio.

I suppose the *Nageoma* to have been the first canoe to cross Brittany because, until our arrival at Nantes, we met no one who had ever seen such a craft. Indeed, except at Nantes, we encountered no pleasure boating until we reached the Seine. The sensation which we created along those quiet countrysides in the Department of Côtes-du-Nord was extraordinary.

As our green-canopied craft glided past, the "man with the hoe" forsook his traditional Milletesque posture and came leaping across his turnip patch to stare. Women kneeling on their wash-boxes along the bank ceased scrubbing and sheltered their astonished gaze with suddy hands. Whole families, from grandparents to toddlers, hurried forth from some thatched farmhouse to exclaim rapturously, "That's *chic*, that is!" or, "What a *gentille* promenade!"

A MAID OF BRITTANY

Photograph by Crété

THE TWINS

Photograph by Crété

A TWO-STORY BED IN A BRETON COTTAGE

These curious compartments look as if they might have furnished the genesis of the idea for the Pullman berth.

Photograph by Emil P. Albrecht

MARKET DAY IN RENNES

With her arms full of baskets and baby, she offers her wares for sale in the ancient capital of Brittany.

Photograph by Emil P. Albrecht

ONE OF THE FEW RELICS OF MEDIEVAL RENNES

Part of the ancient Convent des Carmes, founded in the 15th century. The old wooden staircase, with its slate roof, clings to high houses with open galleries, now tenements, but once imposing residences. This old city of the Celtic tribe of Redones was almost completely destroyed in 1720 by a conflagration which raged for seven days.

Stupefied cows mooed at our approach; canal-boat drivers covered the eyes of their shying horses; and draft-dogs, hitched to handcarts, barked furiously as we overtook them. One inquisitive old dame trudged alongside us for quite an hour; and when at noon we rolled up our side-curtains and set forth stove and luncheon impedimenta on the camping-table, she sat down heavily, exclaiming, "*Mon Dieu*, but it is a little hotel!"

NEGOTIATING A LOCK IS A PICTURE-BOOK EXPERIENCE

Locks, locks, and locks! During the first five days we passed through 48 of them, and once we encountered 13 within four miles.

It was an off season for canal-boat traffic, and, in fact, during the first 200 kilometers we glimpsed no craft of any kind; the waters were all our own. Though this was not without its charm, we often had to climb ashore and search the countryside for the éclusier who customarily cultivates his garden during the slack season. When once we had found him afield, the conversation was invariable:

"You would pass the écluse, M'sieu?"

I nod assent; then follow him to his little house, which gleams snowy white amid its mazy flower garden and red-fruited apple trees.

"You have authorizations, M'sieu?"

I tender my papers and he stumbles at once upon the strange word, *canoë*.

"You have come from far, M'sieu?"

"From St. Malo."

He has been studying me, albeit po-

Photograph by Topical Press Agency

A CARTLOAD OF BRITTANY CHILDREN

litely, quite as much as he has been scrutinizing that unknown word, *canoë*, and I judge that he takes me for some eccentric millionaire with a steam yacht.

"The tonnage of your boat—it is considerable?"

I lead him to the waterside, and he glimpses the *Nageoma*. After a prolonged stare, he goes off; then returns with a couple of enormous life-preservers, which he gravely hands to us before opening the lock.

But, thanks to the good-natured éclusiers, who would always moderate the water's inrush by opening the sluices gradually, our unpleasant experience at Le Châtelier was never repeated. In fact, locking through—and especially in "descending" locks, where the water sinks to the level of the stream ahead—becomes even an absorbing, picture-book experience. Down you go, gradually losing sight of the world, as the lock walls rise towering about you. The ponderous gates ahead of you, closed like some big, black book cover, set you to wondering what lies behind them. Then slowly they open—the book covers part—and some new and charming picture, a Corot or perhaps a Cazin, is disclosed.

IN A BRETON PIG MARKET

Photographs by Emil P. Albrecht

A CORNER IN THE SHEEP MARKET OF A BRETON VILLAGE

The fact that it is raining and the animals are huddling in an effort to find shelter gives them the appearance of being camera-shy.

Photograph by Crété

BRETON FISHERMEN WITH THEIR CATCH

Photograph by Emil P. Albrecht

A RAINY DAY IN A BRETON CATTLE MARKET

The women are quite as keen as the men at buying and selling pigs, sheep, goats, and cattle. White caps and gay aprons are as numerous as smocks and velvet hat-ribbons.

Photograph by Melville Chater

"WE CAUSED VARIOUS EMOTIONS AMONG THE RIVERSIDE WASHERWOMEN AT THE BACK DOORS OF FRANCE"

The washerwoman kneels inside her small box and thumps and paddles the linen on a board which extends from its front end. It looks rather like a wheelbarrow without a wheel.

Photograph by Crété

DRYING BRETON BONNETS

At Tinténiac we rested for a day at the inn, if you could so name a clean, paved kitchen with great crocks on the open fireplace, with sausages festooned along the rafters, a cider-press in one corner, and tables of cherry-wood, smooth and rich as old satin. And here the peasant-folk quaffed bowl after bowl of Brittany cider, and the lame lock-keeper recounted to us the manner of his receiving his seven wounds, when on the Marne in 1914, his ammunitionless regiment had fought *"à la fourchette,"* as he said, with a bayoneting gesture.

EVERY BRETON VILLAGE HAS ITS WAR MEMORIAL

Yes, although Brittany's *"petits pays"* smile with corn and orchards, and her farm hands grub cheerily in the fields for 15 hours daily, and there is always a genial welcome for the back-doors traveler, those tiny village churches of hers, where the plain shaft stands to commemorate "1914-1918," tell the same silent story. *"St. Gatien to his children who died for France."*

Or it may be St. Domineuc, or St. Grégoire, or St. Médard, or other of those early fathers after whom Breton communities are so devoutly named. There may be 200 people in the village and there are 25 names on the shaft. Truly, each towering cross, with its gigantic figure nailed thereon, which for centuries has dominated the one straggling street of each Breton hamlet, has its renewed significance to-day.

At Rennes, where everybody save those actually in jail was surging on the bridge to greet us, we locked through into the Vilaine River. It was another lovely stream, which wound its way through a flexuous, closely shorn land of, one might almost say, natural golf links.

Perhaps it is an indirect compliment to the beauty of French waterways that this one should be called Ugly River. Certainly the fishing party from Paris, with whom we partook of *déjeuner* at small tables in an embowered inn-garden at Pont Rean, didn't find it ugly. They suggested that the name might express mere homely affection, just as the French peasant tenderly calls his wife "my little cabbage."

Photograph by C. A. Slade

A FARMER OF BRITTANY

While the chief calling of the men of Brittany is the sea, the Breton is a successful market gardener in the fertile coast regions.

Photograph by Crété

BRETONS IN HOLIDAY ATTIRE

One of this party, observing a venerable fisherman who sat sound asleep on the river bank, rod in hand, stealthily abstracted from the old man's basket the single fish which it contained and hung it on the hook, which he then dropped back into the water. Presently the fish revived, the old man woke up with a jerk and landed his catch. A moment later he came hurrying into the inn-garden, all excitement.

"Monsieur Michel," he cried, addressing the proprietor, "here is a miracle of a fish! I catch this fine fellow, who when I am asleep jumps out of my basket back into the water, and then gets himself caught a second time. He shall be stuffed, this jumping prodigy, for my collection. Nothing like it was ever heard of along the Vilaine!"

HOSPITALITY ALONG THE ROUTE

During the next five days, spent in traversing the Vilaine's 90 sinuous kilometers which stretch between Rennes and Redon, we passed only lock-keepers' houses, isolated farms, and an occasional cluster of red roofs, where a perfect census of the inhabitants was obtainable by merely counting the rustic fishing-poles which overhung the river's surface.

Throughout those five days the rain

Photograph by Crété

BRETON MUSICIANS OF PONT-AVEN

Pont-Aven is a picturesque little village, formerly much frequented by artists. It has been called "The Millers' Town," because of its many riverside mill-wheels, and also "The famous town with fourteen mills and fifteen houses." Anatole France has written about the gracious young girls of Pont-Aven, with their great white quilled collars, windmill coifs, and black, accordion-pleated skirts. The hats of Breton men are distinctive, being low-crowned and wide-brimmed, with long velvet ribbons hanging down behind.

descended in torrents, while we either donned mackintoshes and pushed ahead or retreated within the snugly curtained center space and let the elements howl.

As for meals, under these conditions, there was always a kindly lock-keeper and his wife who would ask us into their little flag-floored house, where, under some patriotic lithograph depicting Mademoiselle Alsace in the liberating poilu's embrace, we would dine *en famille* on cabbage soup, country cheese, and cider, departing with a huge bouquet of geraniums or chrysanthemums, which the good wife would insist on picking for us from her garden.

The French lock-keeper is sometimes an old soldier, but oftener is some black-clad woman who took up her husband's duties when he was called to the front, and who (for he never came back) will continue them until her little François is grown up—or, as she sometimes sadly puts it, "Until he comes back safe, as I hope, from the *next* war, M'sieu."

At Redon we were informed that a three days' delay would be necessary, as the lock was undergoing repairs. However, a canoe possesses some advantages over a canal boat; and great was the excitement among the families aboard the waiting flotilla of canal boats when we put the *Nagcoma* on a hand-cart drawn by draft-dogs, transported it around the broken lock, and launched it in the Nantes-à-Brest Canal.

MEMORIES OF AMERICANS WHO ATE "COW FODDER"

Then for five more days we paddled along the 100-kilometer stretch of stream that unfurls itself ribbonlike among rolling, windmill-topped slopes between Redon and Nantes.

We found that the countryside still fondly recalled the passage of American troops in 1918—how they had swum in the canal, and had given the children little packets of chewing-gum, and had strangely delighted in consuming cow-fodder.

This last detail was related to us by

Photograph by Crété

MAKING WOODEN SHOES

a farmer, who added, "Most vigorous young men those, M'sieu! Wonderful teeth, wonderful stomachs! How they could ever digest that stuff was the wonder of the countryside." And he pointed to one of those fine fields of Indian corn which in France are cultivated exclusively as cattle food.

"Why, that's easy!" we confided; "all Americans eat that." And we described the manner of preparing and dispatching an ear of corn. Suddenly a light broke on the listener's face:

"Ah," he exclaimed, "I understand! Then one doesn't eat it, cob and all, like the cow; one just picks at it, as it were an artichoke, *n'est-ce pas?*"

WHERE QUEEN COW COMMUTES

It is indeed a case of Queen Cow in Brittany. Not only are cornfields planted for her, but, as we saw on the Nantes-à Brest, she actually "commutes" across the canal in a flat-bottomed boat, morning and night, to and from the most favorable of grazing grounds.

At Blain a glimpse of the Château de la Barrière warned us that we were quitting *"les petits pays,"* and not long after we issued upon the wide Erdre, with its fine panorama of oak-clad heights, successive châteaux, and riverside tea-gardens, where oarsmen of "sixes" and "eights" were regaling themselves after their dash down from Nantes.

Even in that big town, when we dropped anchor in the barge-crammed canal we hadn't lost the back-doors aspect of things. With our green canvas roof over our heads and the deck of an adjacent barge to cook on, we were fairly in the bosom of homely family life.

These big canal boats, gaily painted with red and green stripes, bearing two enormous wooden rudders, and embellished by geranium gardens atop the cabins, constituted hearth and home for the wives, who sat knitting socks, and the husbands, who were wheezing "Madelon" on mouth-organs, and the half-dozen romping children, and the back-arched cat, with her eye on the bone-gnawing puppy.

The Walrus and Carpenter, the barge on which we cooked our meals, was so named by us because her cargo consisted of "such quantities of sand." Just as Normandy is renowned for its cheese and Marennes for its oysters, so is the Loire for her sand, as innumerable barges and at least one canoe, as you will hear, can bear witness.

FLOATING LAUNDRIES AT NANTES

Another feature of back-doors life was comprised in the twenty-odd enormous wash-barges anchored on each side of the

Photograph by Crété

DECORATING WOODEN SHOES

canal. At Nantes they "wash their dirty linen in public" and on a vast scale. The lower decks of these *bateaux-à-lavoir* contain hot-water boilers and are fitted with broad gunwales, which are used as wash-rooms. Their upper decks consist of drying-space, for use in wet weather.

The public washerwomen pay the *patron* of the barge one franc apiece daily and prorate the fuel charge. Early each morning they appear with wheelbarrows full of dirty linen. All day long they stand side by side at the gunwale wash-board, soaping, rinsing, and beating the linen with their flat paddles (see p. 40).

Toward afternoon the entire canal frontage is white with acre upon acre of drying clothes. And at sunset the finished handiwork is loaded on the barrows and the washerwomen trudge away through the streets, on their respective delivery routes.

Such is the daily routine of the "Washerwomen's Boulevard" — a sight whose magnitude amazes you until you realize that you are beholding the public laundry of 170,000 people.

The traditional temper of the Nantese is epitomized in the local statue of their hero, Cambronne, who, when ordered at Waterloo to surrender, replied contemptuously, "The guard dies, but never surrenders!"

THE NANTESE FOUGHT FIFTEEN HUNDRED YEARS FOR FREEDOM

For fifteen hundred years the Nantese strove successively against Roman, Norman, English, and, last, the French for the independence of Brittany. They preferred their secluded dukedom to being under a king of all France; and though they had finally to yield, in 1793 they did their utmost revolutionary bit in the cause of the people.

If anyone wants proof of the fighting spirit of the Breton, let him search out, in the local museum, the tanned skin of a certain unknown soldier. "I won't be able to fight after I'm dead," this hero told his comrade when he fell, mortally wounded, "but at least I'll keep on making a noise in the world. Just you have my hide tanned and made into a drum-head, to put heart into the boys when I'm gone!"

His wish was only half fulfilled; yet let us hope that some war poet of the day made this dauntless warrior's words reverberate in his lines.

THE "NAGEOMA" PASSING THROUGH A LOCK

France has great reason to be proud of her canal system (see text, page 48). Water traffic is chiefly in heavy merchandise. The system attains its greatest utility in the northern part of the country, and more than 773 million kilometric tons of merchandise are carried annually.

Photographs by Melville Chater

"WASHERWOMEN'S BOULEVARD" AT NANTES (SEE TEXT, PAGE 39)

Photograph by Emil P. Albrecht

A "PONT TRANSBORDEUR," OR FLYING BRIDGE, AT NANTES

The suspended car (lower center of the illustration) moves with perfect rigidity, no motion being felt. Marseille and Rouen also use bridges of this type. Nantes is noted especially for its numerous bridges over the different arms of the Loire and the Erdre. Founded before the Roman conquest, Nantes is to-day a bustling modern city, its port being what one Frenchman calls a "tumultuous vision," made up of forests of masts and smokestacks, sugar and oil refineries, and ship houses.

We left the canal, and, choosing the slack-water hour preceding flood-tide, ascended the Loire toward the château country. Now, I am certain that, in centuries past, when châteaux were military strongholds, they never obstructed navigation on the Loire half so effectively as the river's sand-shoals do to-day. Rightly is the sand of the Loire famous—or infamous, if you choose to regard it from the canoeist's viewpoint.

Though the French glass and cement industries work overtime and the dredges do their best, their united efforts at exhausting the sand of the Loire are about as effective as "seven maids with seven mops" sweeping up a sea-beach. It was hopeless, even for a canoe; so we shipped the *Nageoma* to the middle Loire, where the châteaux are many and the sand-shoals are fewer.

Langeais, Luynes, Amboise, Chaumont, Blois — outstrung jewels on the river band of the Loire! Yet they are jewels which were fashioned and set on their river-commanding heights at different periods and with different aims. Nevertheless they have an historical bond, since most of them occupy the sites of Roman camps, from which they derive their names.

Langeais is a corrupted form of Alingavia, and Maillé (the older name of Luynes) is but a slight modification of Malleium. But Gallia declined to remain a Roman colony, and by degrees these sites fell into the hands of the early Frenchmen. Thereupon they erected fortresses, and, the Romans being out of the way, proceeded to battle among themselves.

Luynes' grim walls and unornamented towers give us a fair idea of what this military fortress was in the twelfth century, when the powerful nobles warred against each other and even against the king.

Around Langeais centered the great

Photograph by Crété

THE CHURCH OF NOTRE DAME: ANGERS

"Black Angers," home of the Plantagenets, occupies rising ground on both banks of the Maine. It underwent an almost complete transformation in the 19th century, its ancient ramparts being replaced by boulevards and numerous large edifices constructed. The noted sculptor, David, was a native of Angers. The region surrounding the city is famed for its nurseries and market gardens.

Photograph by Emil P. Albrecht

SQUARE ÉMILE ZOLA AND THE CATHEDRAL TOWERS OF TOURS

The Cathedral of Tours was begun in 1225 and was dedicated to St. Gatien, who introduced Christianity into Touraine. Honoré de Balzac, who was born in Tours in 1799, has described the city and the surrounding country in several of his novels.

battles between the counts of Anjou and the barons of Touraine. From behind its walls Richard of England (who was also a count of Anjou) defied the crown, and for centuries the English continued to use the castle as a base for gentlemanly brigandage, until the unhappy neighborhood bought them off with 2,000 gold crowns, stipulating that the fortress be destroyed.

Thereafter hard-fisted Louis XI, having quelled his unruly vassals and unified France, rebuilt for himself a modified Langeais—the castle as it stands to-day. He wished to create an amicable impression among the Tourainians by having, not exactly a fortress, but a royal residence, in their country. And so he erected a crafty combination of ornament and bulwark—say, 25 per cent residence and 75 per cent fortress.

MILITARY STRONGHOLDS LOST THEIR AUSTERE ASPECT

Amboise and Chaumont belong to the same century as Langeais and show the same tendencies. They are military

Photograph by Crété

OLD SEA WOLVES AT A BRETON SEAPORT

strongholds, softening under ornamentation of pinnacle and carving toward a purpose which became always less warlike and always more luxurious.

Of this gradual transition the final stage is seen in the châteaux of Blois and Azay-le-Rideau, where not a ghost of the somber feudal fortress remains; where windows, and not loopholes, look out upon parks instead of drawbridges, and where ornament expands into the embroideries of a pleasure palace in which the rustle of silks has replaced the clang of mail.

Blois is for the traveler who prefers to hobnob with the ghosts of gorgeous cardinals and queens and satin-doubleted courtiers.

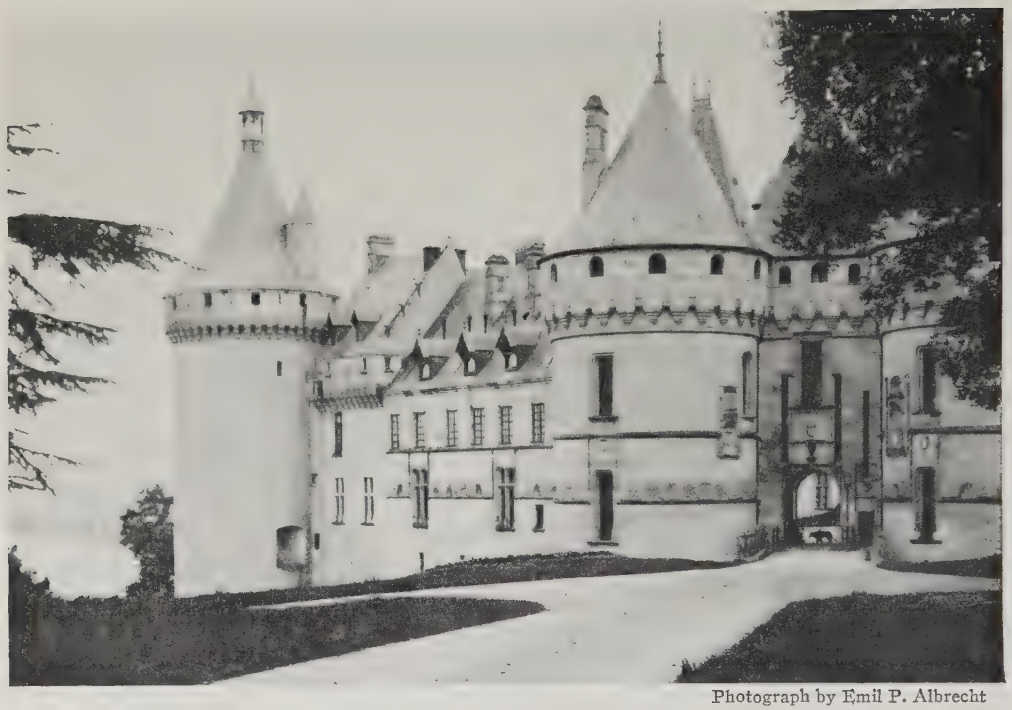
But whoso would conjure up visored knights, and the whizz of crossbow-bolts, and the thing called feudalism, let him visit hill-perched Luynes, its four grim turrets frowning down upon the tiny, nestling village which of old contributed its tithes and pikesmen, and whose house fronts still bear the carven saints who for centuries have witnessed the tramp of troops on their way to war.

At Luynes we discovered a very humble inn where the defects in the cuisine

Photograph by E. M. Newman

THE CHÂTEAU AT AMBOISE, ON THE LEFT BANK OF THE LOIRE

Amboise has been called "a little, white-faced town, staring across an admirable bridge and leaning . . . against the pedestal of rock on which the dark castle masses itself." It was here that the young Mary, Queen of Scots, spent some time after her first marriage. Here, also, tradition says that in 1560 Catherine de Medici forced her to witness from a balcony the wholesale *noyades*, or drownings, of captured Huguenots in the Loire. Both Amboise and Tours lie in a region rich in vineyards, and known as the Garden of France.



Photograph by Emil P. Albrecht

THE 15TH CENTURY CHÂTEAU DE CHAUMONT, NEAR BLOIS

Built on the site of a castle of the 10th century, by Pierre d'Amboise and his son Charles, this impressive pile of masonry sits proudly above the Loire, flanked by the trees of its great park. It belonged once to Catherine de Medici, to Diana of Poitiers, and, in the time of Napoleon, gave shelter to Mme. de Staël. It is now private property, containing an interesting historical museum, which is open at stated intervals to visitors.

were almost compensated for by the genius of its sole waiter. He was a marvelously cheery little man who encouraged us by sniffing distantly, and with rapt, half-closed eyes, at the alleged aroma of the poorest of pinkish wines. When the establishment served bread-and-water soup three times running, he anticipated our flagging enthusiasm by announcing it successively as *"Soupe Grand'mère," "Potage Grand-père,"* and *"Soupe Bonne Femme."* And when it appeared for the fourth time, he hastily dropped a boiled onion into it, exclaiming with a touch of grandeur, *"Voici, monsieur et madame—Purée au Millionnaire Américain!"*

ENCOUNTERING A FAMOUS CHEF

At Orléans we regained the canal, with 125 kilometers to go before reaching the Seine. It was pleasant to return to the back-doors country, where our friends the lock-keepers always smiled a welcome, and where between locks long silences reigned and living landscape merged so perfectly with watery reflection that the vista might have been turned upside down without our perceiving the difference.

We were passing the limits of château-land, and our last glimpse of riverside turrets revealed the final lapse of baronial dignity—a sixteenth century château, now dwindled into a peasant's farmhouse.

Our stores were running low and canned-goods rations were beginning to stir us with certain cravings to arrive at Paris, when one evening we sighted the village of Grignon. On the bank stood a dubious-looking inn of the kind where cabbage soup is the main dish and where your bill is brought to you chalked on a slate. Nevertheless, we entered and announced unemotionally that, whatever was to be had, we would dine on it.

Thereupon clatterings commenced in the kitchen, and an uncle of the family

Photograph by Emil P. Albrecht

ENTRANCE TO THE CHÂTEAU OF BLOIS

The façade of the wing of Louis XII was built, in 1498-1503, of small black and red bricks. The ornamental entrance gate has a Flamboyant niche, with a modern equestrian statue of Louis XII, second husband of Anne of Brittany. His emblem, the hedgehog, surmounted by a crown, can be seen above the great arch and the small door.

appeared and we fell into conversation with him. It turned out that he was someone's chef on a vacation. He had cooked, cooked, cooked, he said sullenly, and never, never did he want to look on a gridiron again; he was here to forget all that.

Upon learning that we were Americans, he beamed unexpectedly, then left the room. Five minutes later we heard his voice scornfully upraised in the kitchen: "Imbeciles! Farm hands! What do you know about the culinary art? There, let me do it!"

Photograph by Emil P. Albrecht

THE CATHEDRAL OF SAINTE CROIX: ORLÉANS

This structure displays a last lingering phase of Gothic architecture. Begun in 1287, it was destroyed by the Huguenots in 1567, but rebuilt in the period between 1601 and 1829. The towers are 285 feet high, and terminate in crown-shaped galleries. The central spire rises 325 feet. The adjacent theater was once the Church of Saint Michel.

And he did it. How he conjured that delicious meal out of Grignon's slim resources remains a mystery. But later, when he appeared in snowy cap and apron to receive our congratulations, part of the mystery was solved.

"Monsieur and madame," he admitted, smiling, "I am—I have the honor of being chef to the American Ambassador at Paris!"

At Buges, where the Orléans, Briare, and Loing canals intersect, we locked through into the last named and were soon amid the press of a canal-boat traffic which increased hourly.

The locks in the back-doors country are built to accommodate one boat at a time, and boat fits lock with a skin-tight nicety, its passage through resembling somewhat the drawing on and pulling off of a glove.

"TRACTION PERFORMED BY HORSES, ASSES, AND MEN"

Often between Buges and the Seine we beheld the odd sight of a man with the tow-rope hitched about his middle, dragging along some ponderous barge, mile after mile, while he smoked his pipe and read the morning newspaper. As the *Guide Officiel* naïvely puts it, "On the Loing the traction is performed by horses, asses, and men."

The French canal system dates back to 1638, when the Canal de Briare was constructed. Since then it has swelled into a vast complexity of routes which total more than 3,000 miles of canals and nearly 7,000 miles of navigable rivers, canalized and noncanalized.

It is no exaggeration to say that traffic may be moved from any one to any other part of France over this remarkable system, which entails an annual upkeep expenditure of 30,000,000 francs. Its longest link is the Canal du Midi, which extends 380 miles across southern France, connecting the Rhône with the Atlantic Ocean.

The maximum of traffic is found on the Marne-au-Rhin Canal, which in 1919 carried 110 million K. T., or kilometric

Photograph by Topical Press Agency

THE STATUE OF JOAN OF ARC IN THE PLACE DU MARTROI, ORLÉANS

Orléans shares with Rouen the chief honors of association with the Maid of France. She is described as the "Victrix Anglorum" on a memorial tablet in the cathedral, and the town is full of monuments to her memory. The anniversary of the Maid's raising of the siege of Orléans, in 1429, is usually celebrated with great pomp.

tons. A K. T. is one ton which has been transported one kilometer. Multiplying thus the tonnage carried by the distance it moved, we find in the same year a grand total of 773 million K. T. as the canal traffic of all France.

STORIES THAT NEED A DE MAUPASSANT TO RECORD THEM

An entire article might be written on the canal boatman and his gregarious life among the beautiful back-doors countries of France. He is a kind of water-gipsy, and nothing can woo him to conventional housekeeping in big towns. The very names of canal boats form an interesting study. In the heart of Brittany, for example, you find religion and sentiment predominating, as in such names as *"Good St. Médard," "The Young Marie,"* and *"The Beautiful Lucie."* As you near Paris, you glimpse such materialistic appellations as *"Big Business"* and such frankly cynical ones as *"The Hope (?) of Love."*

And the human stories—lost for want of a de Maupassant!

One night, as we sat in a wretched canal-side inn at Nemours, there entered an old, horrible, toothless wreck of an Alsatian, who obviously had disregarded the inevitable placard which in such resorts proclaims against public drunkenness.

The proprietor knew what he wanted and, without being asked, turned on a mechanical piano, to whose strident strains the old man began solemnly waltzing about the deserted café, his arms inclosing some imaginary partner. After three waltzes and as many brandies, he fell into a chair by us and said:

"Ain't I an old sight, though? Would any of the girls in the big café opposite dance with the likes of me? Ah! but once I was a spry youngster, and whenever my canal boat touched at Nemours I used to waltz in this very room with the *patron's* daughter, Leonie. Yes, and I named my boat *La Jeune Léonie;* and

Official photograph, U. S. Army Air Service

"MONSIEUR, THIS IS PARIS"

Looking across the Place de la Concorde toward the imposing colonnaded Madeleine. The bridge in the foreground is the Pont de la Concorde.

when a barge skipper does that, you know what it means.

"But I didn't pass here but once in six months, and when I dropped in one day she was gone—had married a baker at St. Mammès.

"Well, I renamed my boat the *Who Cares.* And when a man does *that,* you know what it means. Oh, yes, I married, and had a fine, big family, and renamed my boat *The Good Wife.* But they all died or left me, and my boat went up the backwater, as we say when a barge skipper has to sell out, and now I'm just an old, toothless donkey-driver on the canal path.

"But still, whenever our barge touches Nemours, I drop in here at the old place. Maybe my boat 'll come down the backwater some day; and if she does," and he vowed it to heaven with a vinous smile, "she shall be called *La Jeune Léonie!*"

Twenty kilometers beyond Nemours we passed the last lock of the back-doors country and floated out upon the Seine—noble curves winding between magnifi-

cently wooded heights which sloped downward into level swards, where white villas gleamed among overarching trees.

But there were still locks ahead—nine big ones, each capable of holding 16 barges at a time, and necessitating a delay of from half an hour to an hour, depending upon whether we locked through alone or in company with a full quota.

Racing a string of steam-towed canal boats is really more exciting than it sounds. Though we could pass them readily enough, our object was to lock through before the far-off tug whistle warned the keepers of the flotilla's approach, when we would be detained for its arrival.

Sometimes the *Nageoma* won and locked through alone, looking like a peanut in a swimming-bath. Sometimes we lost and locked through in company with 16 big barges. At Vives Eaux, where it was the latter case, the final boat had just entered the lock when the keepers discovered that the sluice mechanism was broken. It would entail, they announced, a 24-hours' delay.

"GOOD LUCK, SHRIMP AMÉRICAINE"

Now, we didn't relish the prospect of lying overnight in that cement tank. As for the bargees, they gesticulated, and cursed, and upbraided the lock-keepers with a violence which boded the drawing of clasp knives.

In a lucky moment one rough fellow discovered the *Nageoma* lying wedged in among the canal boats and looking like a minnow among a school of whales. He fairly gaped, then yelled to his comrades:

"Hi, you! Here's a shrimp that's got caught in the lobster-pot!" and immediately we became the center of the picture.

All bad humor fled, and every man lent a willing hand to extricate the "shrimp" which had crossed France from St. Malo. A couple of ropes, 20 stout arms, an "All together, boys!" and the *Nageoma,* baggage and all, was hoisted from the lock and relaunched in free waters.

"Au 'voir!" yelled the grinning bargees, waving after us, "Good luck, shrimp *Américaine!*"

Two more days on the glassiest and fairest of ever-widening waters, while the red roofs of Corbeil and Villeneuve-Saint-Georges slipped past, while noble, tree-crowned heights embraced us, and racing shells darted by, and Sunday parties sat at luncheon in rustic arbors perched among the limbs of waterside trees.

Then the Paris-Lyons-Mediterranean Express thundered overhead, across the stream, and we waved our good-byes to the back-doors country.

Ahead the sky grew murky, where cranes and factory chimneys towered; then certain distant murmurings deepened into a dull roar, as successive industrial suburbs came into view. And finally stone embankments arose on either hand, completely cutting off the prospect.

Wishing to know exactly what suburb we had reached, I ascended a convenient stairway and addressed myself to a man who was leaning over the parapet.

"What town is this?" I asked casually. But he didn't falter or ask me what my barbarous race was. He merely pointed over my shoulder, and I turned and saw it all—the vista of arching bridges, the long, tree-bordered boulevards, and afar off, gray and brooding, the square towers of Notre Dame.

"Monsieur," said the Frenchman, with a polite bow, "this is Paris."

Notice of change of address of your GEOGRAPHIC MAGAZINE *should be received in the office of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your September number, the Society should be notified of your new address not later than August first.*

Photograph from Charles Buxton Going

A SOLITARY MEGALITHIC MONUMENT NEAR PENMARCH, BRITTANY

These menhirs (men = long, hir = stone) are of granite from near-by quarries and were erected no one knows how, though some investigators believe that the lever and the inclined plane were employed. Archeologists have suggested that probably the blocks were weathered out from the underlying beds of rock by the elements and needed little quarrying.

THE MYSTERIOUS PREHISTORIC MONUMENTS OF BRITTANY

By Charles Buxton Going

EVEN in a continent rich to repletion with interest, Brittany is remarkable for the multiplicity of its appeal. One traveler may be engrossed in its ethnology; another is delighted by its architecture; a third is charmed with its medieval picturesqueness and quaint costumes; a fourth shuts himself up to dream over its history and romance, while a fifth satisfies his soul to the full with its eminent paintability.

In any of these seductions, of course, the province may be matched or outmatched by other countries; but it stands unrivaled as the land of those strange megaliths—the *grandes pierres* or *monuments celtiques*—in which a prehistoric race, a people apparently of considerable civilization and intense religious feeling, seem to have striven titanically toward self-expression and to have left, after all, a great but almost unintelligible cry.

That, perhaps, is the enduring emotion left with the visitor to the giant dolmens and the vast alignments of Morbihan. These were the work of men agonizing to the end that they and their dead should never be forgotten. And yet, who were they, and what is it they have tried so hard to say?

THEY LEFT NO WRITTEN RECORDS

Assyria, chronologically still more remote from our era, is as an open book through the almost miraculous recovery of the key to the cuneiform inscriptions; but these herculean toilers of western Europe, transporting and raising their huge boulder monuments on the wild Breton moors, seem mere shadows in the mist, unable, because they left no written language, to speak to us across the centuries.

And yet, through patience in investigation and skill in interpretation amounting to genius, a few eager workers, especially the little group connected with the Musée Miln, at Carnac (50 miles west of Redon, see map, page 3), have begun to explain these monument-builders to us; to draw, indeed, clear outlines of their origin and aspirations, even to sketch something of their social order.

Nowhere in the world could a specialist have found greater wealth of this peculiar archeologic material than lay around M. Zacharie Le Rouzic and the man to whom he affectionately refers as his "regretted master, Mr. J. Miln," in Morbihan and Finistère.

Almost every commune in Brittany has one or two Celtic monuments—indeed, they are found, sometimes in very fine examples, throughout western France. But grouped about Carnac, within a radius of seven miles, there are nearly 300, even counting the hundreds of menhirs in each of the great alignments as a single unit.

Miln's results, gathered in the museum bearing his name, have been and are still being continuously extended and enriched by his successor, and the following summary is based largely on their deductions.

A PLACE OF PILGRIMAGE AND RELIGIOUS CEREMONIES

This region, it appears, was a sort of Mecca, or peculiarly holy ground, to which the remains of heroes and leaders were brought for entombment, to which the faithful flocked in pilgrimages, and in which the great religious ceremonies were held.

Carnac was probably to the western continent of Europe what Stonehenge was to the British Isles. There is at that place, in fact, a focus and concentration of the megalithic works left by the Celtic forerunners in their prehistoric migration which, starting in Asia, moved across northern Africa, over Mediterranean waters, into Spain, and along the shores of the Atlantic, constantly striving westward to find the resting place of their god, the sun, but ever baffled by the impassable ocean, and so forced northward, until the effort died out in Scandinavia.

In their long sojourn near these shores, covering at least 2,000 years, they became increasingly an agricultural people. The weapons and implements placed in the

GROUPS OF MEGALITHS AT CARNAC, THE STONEHENGE OF BRITTANY (SEE TEXT, P. 53)

There are traces of these alignments of stones extending for a total length of nearly five miles. They are in 10, 11, or 13 parallel lines, spreading over a width of 330 to 450 feet. Many of the stones have fallen and been removed by the natives for building use, but nearly 3,000 remain.

sepulchers lose their rough but serviceable character and appear in polished but merely votive forms, often in soft or valuable stone. A few attempts at carving (as in the dolmen of the Table of the Merchants and the tumulus of Mané-er-H'roeck, at Locmariaquer) have satisfied the most careful investigators that some use, at least, of iron—or, at all events, of metal—had begun.

AGRICULTURE EXALTED TO FIRST PLACE

Further, these carvings are best interpreted as representations of agricultural symbols—an ox, a "hatchet-plow," the sun vivifying ears of grain—thus confirming the belief that cultivation of the soil had been exalted to first place.

Ultimately, having lost their military hardihood and having been deterred (perhaps by resistance on the part of the priesthood) from advancing in the use of metals, these stone-users were overrun by bronze-sworded Gallic invaders, and these in turn by the steel-weaponed warriors of Rome.

Each superimposed culture, however, seized upon and adopted, or adapted, some parts at least of the preëxisting beliefs and institutions of the land, and especially its holy places.

The worship of stones (perhaps as symbolizing eternal existence) seems to have continued indefinitely, as witnessed by various edicts of the early Church condemning the practice. A Jesuit writer speaks of it as persisting at the end of the 16th century, and it is indeed represented

Photographs from Charles Buxton Going

LONG FILES OF MONUMENTS ARRANGED WITH MILITARY PRECISION

Legend says that these menhirs were pagan soldiers pursuing Saint Cornély. He, finding further flight cut off by the sea, turned them into stone. Once a year, on Christmas, at midnight, they leave their stations to drink at the streams. Many of the country folk believe that calamity would overtake any who watched for the miracle.

at the present time by superstitions concerning the stone monuments inextricably mingled with the religion of the Breton peasant of to-day, whose chapels and great ceremonial fairs, moreover, are almost always closely associated with the sites of the chief megaliths.

THE SIZE AND TYPES OF MONUMENTS

Nine types and several subtypes of these monuments have been defined, of which the most important are: the menhir, or "long stones" set on end; the dolmen, or houselike structures, with stone slabs or boulders for walls and roof; and the tumulus, or mound. Alignments are groups of menhirs arranged in line or in several parallel lines. Cromlechs are groups of menhirs standing in a circle or an arc of a circle, more rarely a square, usually terminating an alignment or surrounding a tumulus. The dimensions are sometimes incredible.

The Great Menhir near Locmariaquer, now thrown down and broken (probably by an earthquake), was nearly 70 feet high and weighed some 375 tons.

Some of the dolmens have a height of 18 to 20 feet, with roof slabs 20 by 35 feet in area and several feet thick. Baring-Gould indeed mentions one near Névez (Finistère) "whose capstone measures 45 feet in length and 27 feet in breadth and 6 feet thick."

The alignments of Carnac, in 10 to 13 parallel rows, stretch across the country for nearly five miles. The tumulus of Mont St. Michel looks like a natural

Photograph by Emil P. Albrecht

THE TABLE OF THE MERCHANTS AT LOCMARIAQUER, MORBIHAN

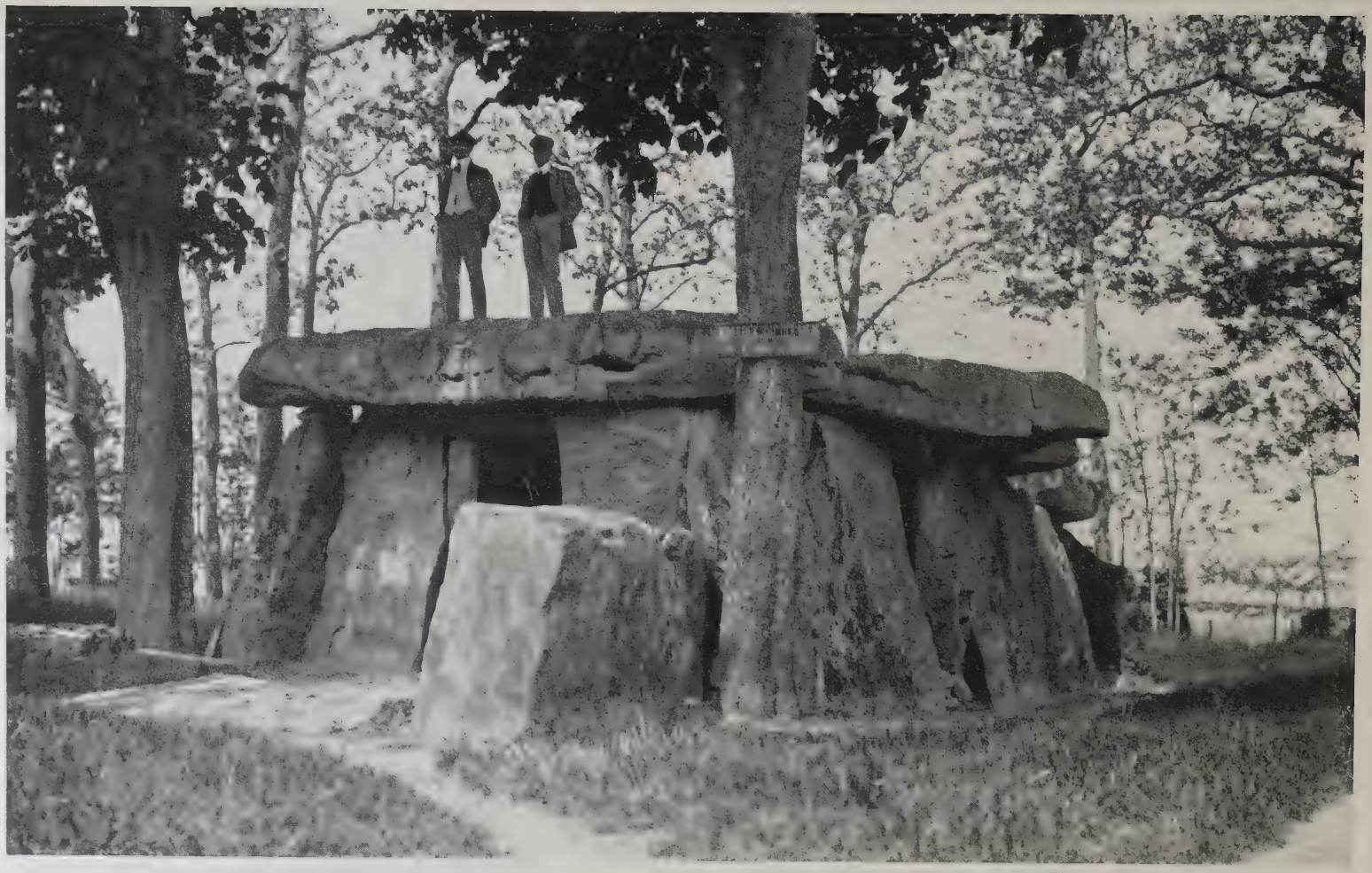
This great dolmen (dol = table, men = stone), which once included the two broken pieces on the right, is celebrated for its grace and the lightness of its points of support. The conical menhir at the left-hand end is covered with indecipherable inscriptions and has something of the appearance of an altar. The table on its supporting stones forms an "allée couverte," in which one may readily walk.

THE KERVERESSE DOLMEN AT LOCMARIAQUER (SEE TEXT, PAGE 55)

Photograph from Charles Buxton Going

A PORTION OF THE "COVERED ALLEY" AT BAGNEUX

All such remains are supposed to have been crypts, covered by tumuli which have since disappeared. This fine example at Bagneux, to the southeast of Brittany, is one of the largest dolmens (houselike structures) in existence, being 65 feet long, 22 feet wide, with an average height of 9 feet. It is composed of 16 vertical and 4 horizontal stones.



Photograph by Topical Press Agency

ANOTHER VIEW OF BAGNEUX'S FAMOUS DOLMEN (SEE ALSO PAGE 58)

It has been surmised that some of the dolmens were shrines to which prehistoric men resorted to consult the spirits of their ancestors The idea has also been advanced that probably the priests of these oracles lived inside the dolmens.

THE KERDERG GIANT AT CARNAC

The parallel rows of menhirs at Carnac have a general east and west alignment and probably terminated in cromlechs—groups of stones standing in an arc or circle (see also illustrations on pages 54 and 55).

Photograph from Charles Buxton Going

THE GIANT MENHIR OF KERZERHO, IN THE ALIGNMENTS OF ERDEVEN

There are 1,030 menhirs in the lines of Erdeven. Their entire length is 5,700 feet and they are similar in many respects to the alignments at Carnac (see pages 54 and 55), but on a smaller scale and of smaller stones.

Photograph from Charles Buxton Going

PART OF THE ALIGNMENTS OF KERMARIO NEAR CARNAC

The great monuments of Carnac consist of three large groups or phalanxes of stones. The country folk of this community believe that unless they prepare a special kind of food and place it upon the tables of the dolmens their crops will be blighted.

Photograph by Crété

THE "CAUSEURS," OR TALKING MENHIRS ON THE ÎLE DE SEIN

This island was once the seat of a Druid sanctuary and oracle. Here tradition says nine damsels, to whom was entrusted a sacred vase, gathered potent herbs, mixed them with sea foam, and boiled them for a year and a day. Three drops of the decoction, which was kept in the vase, when placed upon the lips of the druidic bard, enabled him to behold the future.

A PASSAGE COVERED WITH FLAT STONES AT LOCMARIAQUER (SEE ALSO PAGES 56 AND 57)

Usually these covered passageways terminated in a small chamber or group of chambers, made by partitioning off the end of the passage and using one or more menhirs as supports in order that there might be no definite line of distinction between the dolmen and the alley leading to it. The dolmen was probably used as a sepulcher for the remains of a chief of a line of rulers (see pages 67-68). The openings to the passageways invariably were placed so that they lay between the points of the rising and the setting of the sun at the summer solstice.

Photograph by Crété

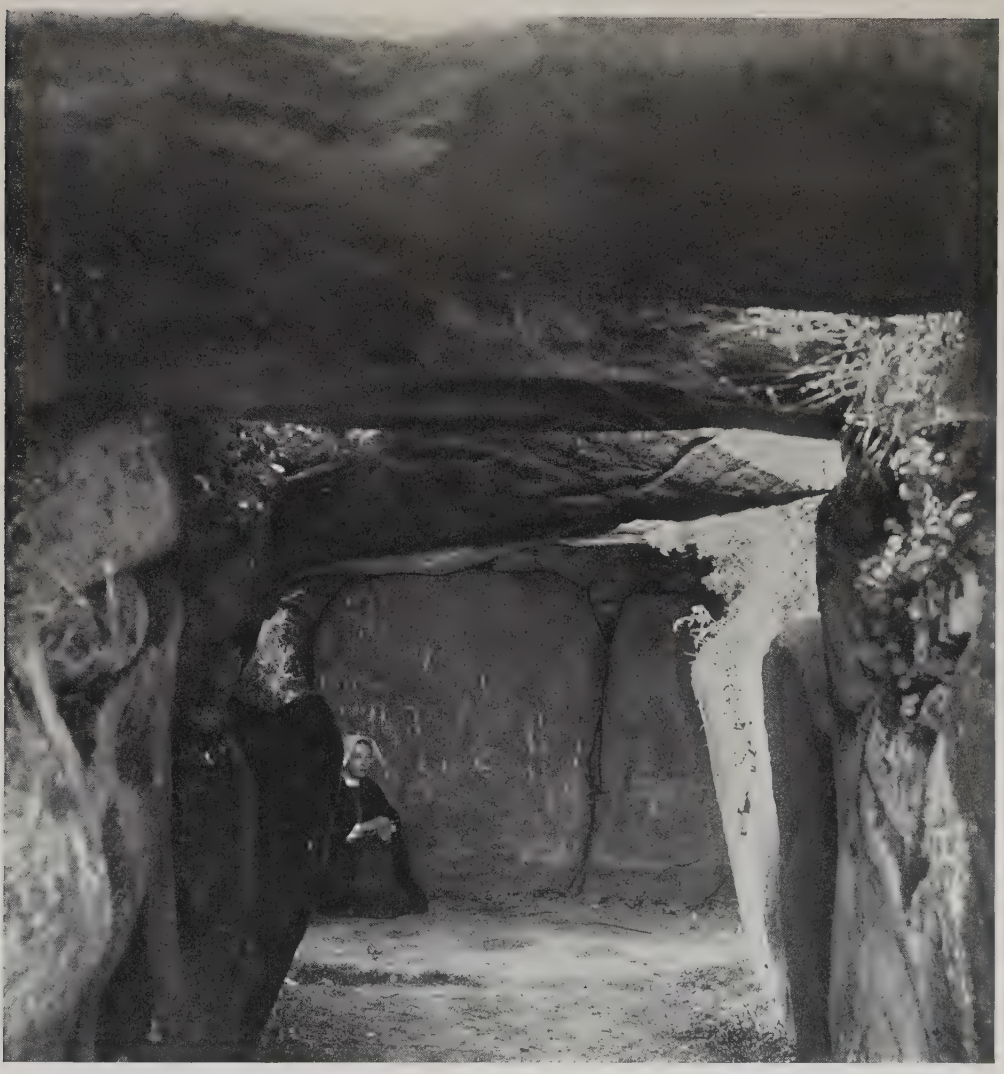
A CABBAGE PATCH IN THE SHADOW OF THE DOLMENS OF KÉRIAVAL, NEAR CARNAC

Some of the stones in the great monuments have tumbled down and have been used to build houses and walls. The little church of St. Cornély at Carnac is built entirely of these stones broken into blocks of convenient size, the crown of its west portal being carved from a single menhir.

Photograph from Charles Buxton Going

TWO OF THE GIANT PREHISTORIC MONUMENTS AT ERDEVEN

The stones at Erdeven are arranged about a circular hillock, which is probably artificial in part, surmounted by two dolmens. Along the southern and western sides of the mound the stones are so small and irregular as not to attract much attention; to the east, however, they become very imposing, some of them measuring from 20 to 23 feet in height, though the general average is from 12 to 16 feet.



PART OF THE PREHISTORIC BURIAL GROUNDS WHICH ONCE STRETCHED FOR MORE THAN 15 MILES FROM LOCMARIAQUER TO CARNAC, ERDEVEN, AND BELZ

The names of many of the local places were derived from the funeral ceremonies which took place within the shrines: Plouharnel means Place of Ossuaries, or House of Bones; Kermario, Place of the Dead; and Kerlescan, Place of Ashes.

knoll, dwarfing the modern chapel which crowns it. It is hard to realize that it was heaped by human hands.

All menhirs, cromlechs, and alignments were from their beginning open to the sky. Dolmens and similar constructions were all originally covered by tumuli, since removed, in many cases, in the course of farming or building operations.

The tumuli were indeed simply tombs, of which the dolmens and "covered alleys" were the crypts. In some the great quantity of skeletal remains, earth-buried or incinerated, would indicate collective sepulture. In other cases, the greater or central dolmen has been found surrounded by smaller dolmens or stone coffers containing the bones of animals and human beings, the latter probably slaves or servitors, all slain to accompany their master into another world, indicating a definite belief in a future life. With these have been found stone implements (celts or hatchets), arrow points,

SENTINELS FOR MANY CENTURIES ON THE BRETON COAST NEAR CARNAC

Various solutions have been offered for the puzzling "why" of these giant megaliths. Those of Brittany are not unique; dolmens have been found in Japan, Korea, Palestine, Algeria, Sardinia, Corsica, Italy, Spain, Portugal, Great Britain, Ireland, Holland, Germany, Scandinavia, and Malta. For a detailed view of the central menhir, see page 61.

and tools of various kinds, fragments of pottery, pendants and beads of turquoise and other semiprecious stones, and amulets of baked clay.

Isolated menhirs have yielded little or nothing indicative of use as monuments for individual tombs. They seem to have been generally commemorative, indicators of roads and territorial boundaries, and "symbolic of an immortal god."

The alignments, on the other hand, appear to have been designed as open-air temples, each group (with its cromlech, placed always at the western end of the lines) having been erected on a single comprehensive plan and at one time. They are the remains of huge religious monuments, the alleys between the parallel files of stones being the aisles in which the devotees gathered and moved, and the cromlech the holy of holies in which the priests performed their rites.

They have a curious general characteristic in that the tallest menhirs are always placed nearest the cromlech, the lines diminishing in height from west to east.

THE MENHIRS SERVED AS AGRICULTURAL CALENDARS

Most interesting of all, however, is an apparently definite scheme of orientation, which tends to prove that, in addition to their ritual use, or perhaps as part of it, these impressive files of monoliths served a peculiar purpose. MM. Henri de Cleuziou and F. Gaillard have pointed out that in each group of alignments will be found a single very large menhir—the "giant" of the group—so placed in one of the outer files that if one stands at a given point in the cromlech he will see the sun rise over the giant at a specific date in the astronomical year.

Captain M. A. Devoir, of the French navy, confirms these observations with greater particularity. "The alignments of Menec and Kerlescan," he says, "give the equinoctial line, while Kermario and Petit Menec give the line of the summer solstitial sunrise and the winter solstitial sunset. . . . Sainte Barbe and Quiberon . . . correspond to the sunrise point midway between the equinox and the winter solstice; Erdeven marks out the intermediate point for the summer solstice. . . . These alignments correspond generally with the following dates: November 8, February 4, May 6, August 8, which are simply the mean dates of the principal agricultural seasons.

"The beginning of November is the time for seeding the crop, which will sprout in February. Blossoming begins in May, and harvest in the first days of August. Thus the Neolithic calendar might regulate the work of the fields, and we know that these Asiatic invaders were agriculturists."

The orientation, be it understood, is not exact at the present date. Calculations made independently by two astronomers reach the same result—that it was correct at a period about 1,600 years before the beginning of the Christian Era. This curious testimony to the age of the monuments agrees with conclusions reached on other grounds by M. Le Rouzic, placing only the earliest of the megalithic structures prior to 2000 B. C.; the greatest development of dolmen-building and the erection of the alignments and cromlechs between 2000 B. C. and 400 B. C., and the latest work, expressed by small galleries and stone coffers, in the first century before the Christian Era.

Local superstition invests the whole region with curious wild beliefs and legends strikingly like the Celtic traditions and folk tales of Ireland and Wales. Lights gleam and flicker among the ghostly stones after nightfall. Strange sounds are heard among them and weird voices cry across the dark. One may meet spectral animals crossing bridge or ford, and escape them only by hastening past the nearest roadside cross!

Many an old man and ancient dame of the passing generation has contributed such items, from veriest personal knowledge, to enrich the "Legends and Traditions of Carnac."

Their belief is implicit. Mystery and magic are the most certain things in life. The great stone monuments have no perplexities for such minds. The dolmens, everyone knows, were the habitations of the Kerions, or Korrigans, a race of very small but very strong dwarfs who formerly peopled the land.

Does not one still say "as strong as a Kerion"? They come back to lodge in their old homes and to dance round about. Woe to him who troubles them! He will die swiftly and surely. As for the alignments, here is the simple tale of their origin:

"In those days Monsieur Saint Cornély was traveling about the world in an ox-cart, and it was he who carried the blessing of God everywhere. But the heathen soldiers wished to kill him and they pursued him. But Monsieur Saint Cornély arrived at Carnac just at that time. 'It is here that I will stop,' he said; 'it is here that I will dwell.' Then he hid in the ear of an ox, and he changed into stone all the soldiers who were pursuing him.

"That is why one sees the long files of stones standing to the north of the town of Carnac, and why often in the night specters walk down these alleys, called 'soudardet san Cornély'—Soldiers of Saint Cornély."

THE "TECATE" IN A SHELTERED COVE AMONG THE SAN BENITO ISLANDS

The Fisheries patrol motor ship *Tecate* was placed at the disposal of the expedition to the desert islands off the coast of Lower California by the Mexican Government, which met the expenses of the party while in the field. The party visited and collected specimens from the islands of Guadalupe, San Martin, Cedros, the three San Benitos, Natividad, San Roque, Asuncion, Magdalena, and Santa Margarita (see map, page 73).

A CRUISE AMONG DESERT ISLANDS

By G. Dallas Hanna and A. W. Anthony

With Illustrations from Photographs by G. Dallas Hanna

The authors of the following article were in charge of the scientific work of an expedition organized under the direction of Dr. Barton Warren Evermann, Chairman of the Committee on the Conservation of the Marine Life of the Pacific, appointed by the Pacific Division of the American Association for the Advancement of Science. The expenses of the expedition were borne jointly by the National Geographic Society, the California Academy of Sciences, the San Diego Society of Natural History, and the Scripps Institution for Biological Research. The Government of Mexico coöperated by providing its fisheries patrol boat, "Tecate," Captain Victor Angulo. During the cruise specimens of birds and mammals, reptiles and amphibians, insects, land shells, marine fossils, plants, fishes, and strange and rare forms of animal life, many of them entirely new to science, were obtained and have been submitted to specialists, who are preparing technical reports to be published subsequently.—The Editor.

THE islands off the west coast of Lower California are widely scattered over a section of the ocean which provides a very scant rainfall. As a consequence, desert conditions prevail among them.

The most interesting of these islands is Guadalupe. It rises precipitously from abysmal depths, a volcano some 12,000 feet high but with only 4,500 feet above the sea. It has never been connected with other shores and it is, therefore, an oceanic island in every respect. All of its animals and plants have either come to it over or through the ocean.

This enforced isolation of the species which have come to Guadalupe has caused them to become modified into many distinct forms which are of great interest to students of biology. But, aside from this "esthetic" value, the island has been of very considerable commercial importance because of the great abundance there at one time of certain species of marine mammals.

Guadalupe is the sole remaining home of the only remnant of a herd of elephant seals in the Northern Hemisphere. Its fine herd of fur seals was hunted and persecuted until apparently the last survivor succumbed to the buckshot of the hunters. At least 200,000 skins of this valuable fur-bearer, which, at present prices, would be worth more than $6,000,000, were taken from the island.

Guadalupe, Mexico's westernmost possession, located 180 miles southwest of San Diego, California (see map, page 73), is about 20 miles long and six miles wide. It is known to have been visited by fur-seal hunters in the early part of the nineteenth century.

These hunters may have been the intrepid deep-water whalers who sailed from New England ports and who occasionally took a vacation from their regular business with harpoon and try-pot to discover and raid most of the fur-seal and elephant-seal rookeries of the world. Or they may have been out for fur seals and sea otters alone, working in partnership, as they did, with the Russian pioneers of Sitka and Kodiak, Alaska. It was these last who took 200,000 fur seals from the Farallon Islands, just outside the Golden Gate, in the short space of three seasons, about 1810.

Guadalupe first appeared upon maritime charts in 1837, after the visit to the west American coast by the French Admiral, Dupetit-Thouars.

The world's greatest herds of fur seals have been so long commercially extinct that people have come to associate the name only with the species which resorts to the Pribilof Islands, in Alaska, where, by long and bitter fighting of diplomatic and legislative battles, the United States has been successful in preserving the largest herd now in existence. But once

THE LANDING PLACE AT THE NORTHEAST END OF GUADALUPE ISLAND

The white building was erected as a barracks when the Mexican Government had soldiers stationed on the island. Most of the other buildings were occupied from time to time by persons interested in the goat ranch (see text, page 82). The buildings were unoccupied at the time of the visit of this expedition.

there were several other herds, much larger, in the Southern Hemisphere.

The species which lived on Guadalupe was akin to these last and not to the Alaskan forms, although the furs were almost equally valuable and brought good profits to the hunters. Guadalupe being such a distant outpost of Mexico, it is doubtful if a single official of that government had the faintest conception of the war of extermination at the time it was taking place.

So far as the available records show, the last living fur seal was seen on Guadalupe in 1892. Since then several expeditions besides our own have gone to the island and searched for the animal without success.

Our party cruised completely around the island, examining the shores minutely, in the hope that at least a single pair had escaped the last butchery. But, after six days of anxious searching, we turned the prow of the *Tecate* toward San Quintin

Bay, fully convinced that we were about 40 years too late to offer this fine species any assistance.

While on the island we examined the ground of three former fur-seal rookeries with scrupulous care, measured the areas and computed the number of animals which once hauled out there to rear their young.

South Rookery originally contained at least 50,000 fur seals and compared favorably with the major breeding grounds of the Pribilof Islands to-day. The entire Guadalupe herd must have numbered at least 100,000 animals when it was in its prime.

Without printed records, how do we know this, thirty years after the last of the animals died? They left their own records, which can be read almost as plainly to-day as if each animal were in its place; and this makes the realization of the facts all the more bitter.

The animals chose the roughest and most rocky shores for their land homes and congregated in large, compact rookeries, in conformance to the habit of fur seals generally. The constant trampling of thousands upon thousands of flippers over the hard blocks and boulders of lava rock wore them down to the smoothness of polished marble. And there they are to-day, silent monuments to a helpless animal which paid dearly for having a skin coveted by man.

THE HERD WOULD HAVE BEEN WORTH MILLIONS TO-DAY

If the original breeding stock had been preserved and allowed to remain constant, only the annual increase being removed each year, the herd would have produced millions upon millions of dollars in the 125 years since the slaughter began. At $30 per skin (present market value of a fur seal), the annual increase from a herd the size of that which once inhabited Guadalupe would be about $750,000. This is 5 per cent interest on $15,000,000, which represents the actual value the herd would have to-day.

So the Guadalupe fur seal has joined the passenger pigeon, the Steller's sea-cow, and the dodo in oblivion.

The great slaughter of the Guadalupe fur seals took place between 1800 and 1830. The hunters then thought they had

A GUADALUPE ROCK WREN

This gentle and confiding little creature greets the visitor upon his first landing on Guadalupe Island. It seems to delight in investigating its human visitors at close range and does not hesitate to perch on hat, shoulder, or foot.

Drawn by James M. Darley

A SKETCH MAP SHOWING THE DESERT ISLANDS OFF THE COAST OF LOWER CALIFORNIA

MASSIVE WALLS OF LAVA, TWO THOUSAND FEET HIGH, BOUND THE ELEPHANT-SEAL BEACH OF GUADALUPE ISLAND (SEE TEXT, PAGE 75)

The animals cannot be approached from the land side; if they were as well protected from the sea, there would be no reason to fear their extermination at the hands of oil-seekers.

killed all the animals, and the island was forgotten for many years; but about 1880 it was rediscovered and several thousand seals were killed in a few succeeding seasons.

Stories are still heard in San Diego of the last killings which took place. The fur-bearers were pursued into the dark recesses of volcanic beach caves and shot or clubbed by the light of torches.

At South Rookery the stone foundations of 16 huts still stand, conclusive evidence that a considerable number of persons must have engaged in the affair. A walled-in driveway was constructed from the beach to the tableland above, where the animals were driven for slaughter. There, on smooth sand, the skins were spread out to dry and thousands of the wooden pins with which the pelts were pegged down still remain, showing the outlines of the skins.

At Jacks Bay Rookery the driveway leading to the tableland was partially constructed of trunks of palm trees carried from far up in the canyons.

FOUR FRAGMENTS OF SKULLS REMAIN

It was at this place, in 1892, that four fragments of skulls of fur seals were picked up and upon these the scientific description of the species was based. These bits of skulls are now preserved in the United States National Museum, and to this day not another fragment has been found, unless some old bones we picked up should prove to be of this species. There is not a published record of a skin or a perfect skull in existence.

The dodo and the great moa of New Zealand are better represented in our museums than this valuable animal which once lived in herds of tens of thousands a few miles from our mainland.

Another interesting sea mammal is the Guadalupe elephant seal—a huge, clumsy beast with a long flexible trunk. The animals were at one time widely distributed and abundant on many of the remote islands of the Antarctic region,* but the whalers soon learned that a fair quantity and quality of oil could be obtained from each carcass. So the slaughter began, and ended only when the species was commercially exterminated.

The animal found on Guadalupe is similar to, but not the same species as that of southern waters, but it suffered equally from the attacks of the whalers. Originally the northern species was found not only on Guadalupe, but also on the San Benitos, Cedros, and even on the coast of Lower California. These outlying rookeries were soon destroyed, however.

More than once it was thought that the last living representative of the species had been killed, but fate has dealt more favorably with it than with the fur seals; each time a nucleus escaped to rebuild the herd.

We found these animals at the original Elephant Seal Beach, a slight indentation of the northwest shoreline of Guadalupe. Precipitous, unscalable cliffs wall in the beach on the back, so we landed at one end very quietly, without disturbing a single animal.

Counts were made and photographs, including motion pictures, were taken. It was found that a much more satisfactory enumeration could be made from an enlargement of the photograph of the herd shown on page 80 than by a count in the field.

On July 12, 1922, we found 264 animals present. The breeding season had passed and, except in a very few cases, the females and young were absent. An estimate of the entire herd based upon the number of males found gave a total of almost a thousand. This was a most encouraging find and served, in a way, to offset the disappointment experienced over the failure to find a single fur seal.

If vandals and unscrupulous hunters can be prevented from raiding the rookery, the species can be preserved indefinitely. Individuals might then be obtained through the Mexican Government for museums and zoölogical parks. And eventually, when the herd shall have increased several fold, the government can doubtless derive a considerable revenue from the surplus of the herd.

MEXICO MAKES GUADALUPE A GAME PRESERVE

As soon as our expedition returned and submitted reports, prompt measures were

* See "South Georgia, an Outpost of the Antarctic," by Robert Cushman Murphy, in THE GEOGRAPHIC for April, 1922.

TOO LAZY AND TOO FAT TO BE IN A HURRY

A Guadalupe elephant seal coming up on the beach out of the sea.

A TRUMPETING DUET

The Guadalupe elephant seals give their call with noses blown full of air like toy balloons and with proboscides placed in widely opened mouths (see text, page 81).

THE GUADALUPE ELEPHANT SEAL SHEDS ITS CUTICLE AS WELL AS ITS HAIR
This specimen is peeling off like a sunburned bather (see text, page 81).

A CLOSE VIEW OF THE ELEPHANT SEAL'S WARTY AND WRINKLED NECK
It becomes a bright geranium pink after the old cuticle and hair have been shed. The body of the animal is leaden gray in color.

NOT DEAD—MERELY ENJOYING A SIESTA ON THE BEACH

THROWING SAND OVER ITS BACK, A CHARACTERISTIC HABIT OF ELEPHANT SEALS
These animals are awkward, slow, and deliberate in their movements on land.

WIDE AWAKE AND WILLING TO HAVE HIS PICTURE TAKEN

The camera was placed only a few feet from this elephant seal's nose.

urged for the protection of these interesting animals. President Obregon, of Mexico, almost immediately thereafter declared Guadalupe Island a government reservation. Unauthorized landing is now prohibited and no elephant seal or fur seal can be killed or molested within three miles of its shores. Heavy penalties have been fixed for violation of the protective measures.

It is hoped that additional protection can be had through a treaty with the United States, and perhaps other countries, similar to the North Pacific Fur Seal Treaty, which has resulted in an increase of the Alaskan herd from 127,000 animals in 1911 to more than 600,000 in 1922.

The success of that treaty has demonstrated that international agreement is the only feasible method of protecting any animal which, during a part of its existence, goes into the high seas. There it cannot be protected by one country against the activities of the citizens of another country, and protection on the high seas is essential if a commercially valuable animal is to be saved from extermination.

The elephant seals are awkward, slow, and deliberate in their movements on land. We soon learned that our fear of disturbing them was groundless, for by degrees the entire party walked down among them and some of the boys even slapped them on the back or vaulted over them. They seemed to have no conception of man or fear of him.

Among these strange animals, we seemed to be taken back several geological periods, to the age of the ungainly dinosaurs of the Jurassic or the slovenly,

MEMBERS OF THE EXPEDITION WALKING AMONG A HERD OF GUADALUPE ISLAND ELEPHANT SEALS

The fact that these animals seem to have no fear of man contributed largely to their almost complete extermination when they were hunted by whalers for their oil.

giant amphibians of Carboniferous time. Many things seemed to show that the elephant seals are the survivors of an ancient lineage and do not properly belong to this age of highly organized and specialized birds and mammals.

THE ELEPHANT SEAL USES HIS SNOUT AS A RESONATOR

Instead of shedding the hair, as do the mammals with which we are familiar, the elephant seal sheds the cuticle of the skin; it peels off in large flakes, like the skin of a sunburned bather, and the new skin on the excessively rough and corrugated neck is left a bright geranium pink. Otherwise the animals are a dull leaden gray, with here and there a silvery sheen, such as we often see on hair seals. To these latter the elephant seals bear a closer relationship than to any other existing mammals.

The flexible snout or trunk reaches a maximum length of 16 inches in old males, and, so far as is known, it serves no useful purpose. When the animal throws its head back and utters its deep, snore-like trumpet call, the end of the trunk, blown full of air like a toy balloon, is placed in the widely opened mouth. An accessory resonator is thus produced, which gives the sound a far-away, uncanny tone, like a distant horn blown in the depths of the Louisiana Bayou country (see illustration, page 76).

The snout of the female is imperfectly developed; therefore this organ would seem to have no association with food-gathering habits, but at present nothing is known as to the animal's food or the manner of obtaining it. Several stomachs were taken for museum specimens; in all cases they failed to furnish any data.

ONE OF NATURE'S MYSTERIES

Several elephant seals were seen in the water, where they appeared as ungainly as on land. They seemed to be especially fond of swimming slowly close to shore, with head and hind flippers both out of the water.

The sea round about is too deep for them to go to the bottom for clams, as do the walruses of Bering Sea, and it does not seem possible that so clumsy a creature could capture the fleet pelagic fishes and squids of neighboring waters. Truly the elephant seal is one of the mysteries of nature.

Even without the fur seals and elephant seals, Guadalupe would be one of the most interesting islands of the Western Hemisphere. The sea has eaten its way into the volcanic materials of which it is composed, and exposed the very hearts of some of the craters. One needs but to sail along close to shore and examine the great dike systems, caverns, lava bubbles, and vents to gain an idea of the tremendous dynamic forces which were once at work here.

Many of the canyons are so full of caves festooned with weird lava shapes that it would seem as if Gustave Doré must have visited the place before he drew the pictures to illustrate Dante's "Inferno."

No doubt the desert conditions of today have prevailed since the island cooled; surface erosion has been so slight that the original features have been preserved almost intact.

Some of the northern portion of the island projects upward sufficiently (4,500 feet) to pierce the lower strata of clouds, and this part is bountifully supplied with moisture, chiefly in the form of mist. Here there are some fine groves of pines, cypresses, oaks, and palms, all species found only on this island.

A BIOLOGICAL SEPULCHER

The first naturalist to visit Guadalupe was Dr. Edward Palmer, in 1875. He camped in one of the cypress groves and described the place as a paradise. There were a great many beautiful shrubs and flowering plants in the moisture belt, and the birds were so abundant and so tame that he called it an isle of dreams. Fully thirty species of plants were found endemic among the 140 kinds collected. Juncos, petrels, caracaras, flickers, house finches, house wrens, rock wrens, and towhees were all about him and all were species never before seen by a naturalist.

But conditions were vastly changed at the time of our visit. Guadalupe is a biological sepulcher.

The shrubs and flowering plants have been practically exterminated and for 30 years no young trees have had a chance to grow. Fortunately, specimens of the

CLIFF-DWELLERS ON GUADALUPE ISLAND

These goats have learned to quench their thirst with sea water and have eaten almost every living plant on the island. They are extraordinarily nimble creatures, and these two specimens jumped 40 feet to the talus slope below and walked quietly away when approached by members of the expedition.

pines, palms, and cypresses have been brought to California and planted in some of the parks. The oaks, which apparently have been neglected, are said to have the largest acorns in existence, being fully two inches in diameter.

GOATS HAVE WROUGHT THIS DESTRUCTION

The old trees are fast disappearing through natural death and the effects of storms. Four of the fine species of birds have become extinct and the others are reduced to a fraction of their former number.

The cause of all this death and destruction was the ambition of some one to start a goat ranch on Guadalupe many years ago. The animals, without care, thrived beyond the wildest expectations of the promoters, but the venture proved a failure financially.

The goats have learned to quench their thirst with sea water and have eaten almost every living plant. In seasons of exceptional drouth, when nothing grows on the lowlands, thousands upon thousands of the animals have died, and the canyons, beaches, and caverns are strewn with their bleached bones.

The only source of fresh water on the island is on the higher portion, where there are some small seepages. Around one of these it was estimated there were 5,000 goats when we were there.

At one time Mexico had a garrison of soldiers stationed on the island, and they built a barrack on the beach near the northeast point; they brought burros and mules to carry water down the mountain, over the excessively rough trail. When the soldiers went away they left the animals to shift for themselves, and we found several of them around one of the water-holes, apparently glad to see a human being once more.

Either the goat ranchers or the soldiers liberated house cats, which promptly turned to wild cats and proceeded to subsist upon the bird life of the island. They have been the direct cause of the disap-

pearance of most of the birds, and we saw evidences of their depredations in the form of loose feathers and wings at every landing we made.

CATS ARE EXTERMINATING THE ISLAND'S BIRD LIFE

House mice were also introduced in the same manner and have completely overrun the island. One might think that the cats would kill the mice very promptly, but the birds seem more to their liking.

The cats will undoubtedly exterminate practically all of the birds of the island in the next few years; there seems to be no practicable method to avoid this ornithological catastrophe.

It has been stated that Guadalupe rises from abysmal depths of the ocean. These great depressions of the bottom of the sea are as effective barriers to the distribution of marine animal life as high mountain ranges are to land forms. As a consequence, we found a very scant fauna along the shores. Of mollusks there were not more than half a dozen common species, whereas in the same latitude on the Lower California coast there are hundreds.

THE CALIFORNIA JEWFISH RESEMBLES OUR RIVER AND LAKE LARGE-MOUTHED BLACK BASS, BUT ON A GIGANTIC SCALE

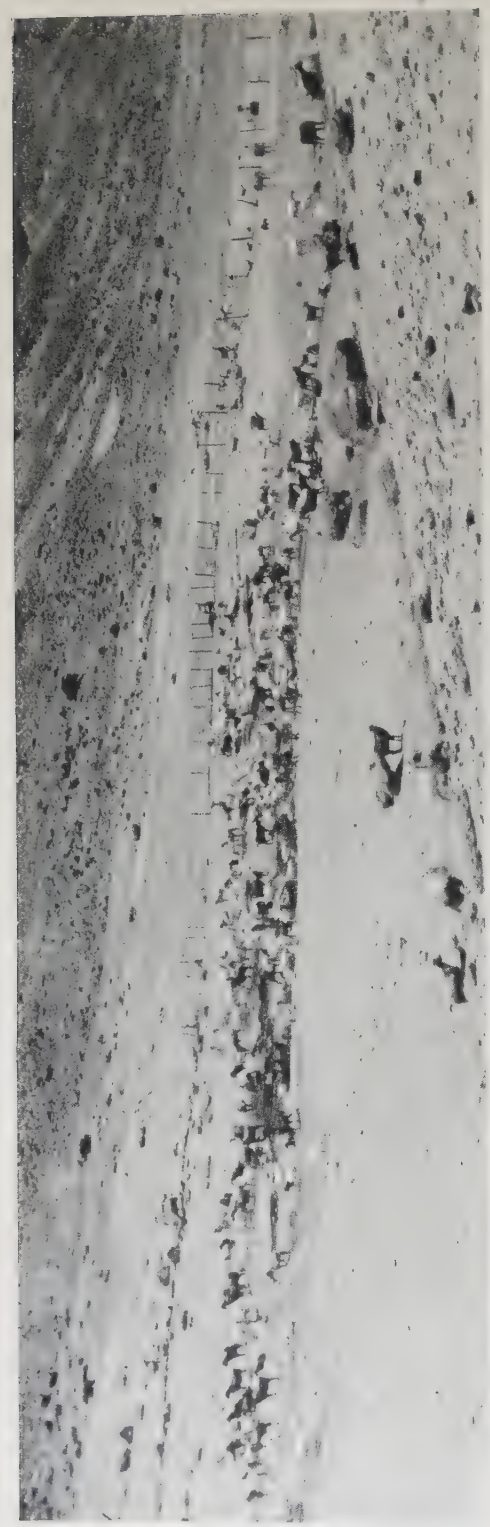
Although this fish attains a weight of 400 pounds, its flesh is not coarse or unpalatable.

Shore fishes were fairly abundant as to individuals, but very few kinds were seen. The most interesting of these was the beautiful *Azurina hirundo*, named by Dr. David Starr Jordan and Richard C. McGregor from three specimens taken there many years ago. These gorgeous little fishes are an azure blue, and as they passed in schools in the crystal clear waters over a background of coral-red algæ, they made a picture long to be remembered.

CEDROS ISLAND, ONCE SOURCE OF OTTER SKINS

Cedros Island is slightly larger than Guadalupe and very different in every way. It lies close up to the Lower California coast, but is separated from the mainland by a deep channel. It gets its name (Spanish for *cedar*) from numerous scrub junipers found growing in some parts, and these are usually called "cedars."

The higher ridges of the north end and the central portion have some groves



A FEW OF THE THOUSANDS OF GOATS WHICH ARE DESTROYING EVERY VESTIGE OF VEGETATION ON GUADALUPE ISLAND

The progenitors of this herd were transported to the island many years ago by the promoters of a goat ranch. The venture proved a failure financially, but the goats themselves have thrived prodigiously (see text, page 82).

of pine trees, but they form a very inconspicuous part of the vegetation.

This island at no very distant date was connected with the mainland, as indicated by the fauna and flora as well as the geology. The northern portion contains metamorphic rocks which in one place are mineral-bearing. Here there has been a gold and copper mine, long since abandoned. Large quantities of machinery and 40 or more buildings stand in a dilapidated condition.

Along the western side of the island are vast beds of kelp, where in the early days of California numbers of sea otters were obtained. The animals hunted crabs around the roots of the kelp and basked in the sun on beds of the fronds. One shipment from San Diego to Manila, in the early days of Spanish occupation, consisted of 9,000 sea-otter pelts. This cargo would be worth more than $10,000,000 at present market prices. Not all of the pelts were secured on Cedros Island, but it was a prolific producer.

A SIX-POWER TREATY PROPOSED TO PROTECT THE OTTER

One of the objects of our expedition was to determine the present status of the sea otter, so as to be able to make recommendations for its protection which would enable it to regain its former abundance all along the coasts of Washington, Oregon, California, and Lower California. We therefore made inquiries about it wherever possible. We did not see any of the animals, but it is probable that there are still a few alive. If stringent action be taken for the protection of the species over a long period of years, it would seem to be possible for the sea otter again to become one of our important fur-bearers.

It has been recommended that

A CROSS-SECTION OF LIFE ON ONE OF THE DESERT ISLANDS OFF THE COAST OF LOWER CALIFORNIA

In the foreground is a group of California sea lions; in the middle background may be seen one of the "islands" of black cormorants (see also pages 92 and 93), and the ridge top at the left is serrated with stately pelicans.

SEA LIONS ON EAST BENITO ISLAND

These animals are far more timorous than the elephant seals; they take to the water at the first sight of man.

WEST BENITO ISLAND'S HERD OF SEA LIONS

The folded and twisted rock formation shown in this photograph was once a large rookery of fur seals, but they long ago disappeared as a result of the onslaught of hunters who came chiefly from United States ports (see text, page 73).

SEA LIONS RESTING ON THE UPTURNED ROCK STRATA OF WEST BENITO ISLAND

These are the animals familiar to vaudeville and circus patrons as "trained seals."

the killing, molesting, selling, or possessing of any sea otter or portion thereof be prohibited for a period of not less than 25 years in United States territory, and that similar action be urged upon other countries. To be most effective, these conditions should be embodied in a treaty entered into by the United States, Mexico, Canada, Japan, Russia, China, and perhaps some others.

There are numerous springs of fresh water in the mountain canyons of Cedros Island, but in few cases do they reach the sea; most of them are lost in the burning sands of the canyon bottoms. Around these water supplies there is a luxuriant growth of vegetation, but elsewhere the lowlands present a desert aspect.

THE ELEPHANT TREE IS AN ARBOREAL MONSTROSITY

Several species of cacti abound, but the most conspicuous portion of the vegetation is the strange, grotesque, elephant tree. With a base three feet in diameter and a height of about eight feet, it would be hard to imagine a more monstrous plant growth; it seems pathological, like a tumor. The bark is yellowish white and

SEA LIONS SPORTING IN THE SURF OFF ASUNCION ISLAND

peels off like that of a paper birch, but is fully an inch thick and upon being punctured exudes a thick, viscous milk (see illustration, page 95).

Near the southern end of the island an abalone packing company has brought the water of one of the springs from three miles inland down to the beach. The pipe is laid on top of the ground. On a July afternoon, when we were there, the water reached a temperature of 145° and could not be used for drinking or bathing. This serves to illustrate the excessive heat of the island desert.

Abalones abound around the rock-ribbed shores of Cedros, and an important industry is being developed. Some of the mollusks are dried for the Chinese market, while others are canned for American consumption. The abalone is known chiefly as the source of the pearly shells used in the manufacture of opera glasses and umbrella handles, but it is a mollusk which many epicures find delicious. It has become so popular as a food in California that it is gathered under stringent restrictions and exportation from the State is prohibited. Mexico has likewise adopted restrictions.

The Mexican abalone diver uses standard equipment and stays down in 25 to 40 feet of water for four hours at a shift. He pries the shell-fish loose from the rocks with a steel bar and sends them to the surface in large wire cages. The drying is done in the sun, after three intermittent steam cookings (see page 94).

FISH MEASURED BY THE CUBIC MILE

The fisheries of this portion of Lower California waters are almost untouched, yet they are capable of very extensive development. Albacore, sea bass, yellow tail, bonito, dolphin, mackerel, jewfish, and sardines exist in untold abundance. Of the last there was a zone completely around Cedros Island at the time of our visit. The numbers were so great that

they could hardly be estimated except by some such unit as a cubic mile.

Other fishes in inestimable numbers were preying upon them. The giants of all were the great jewfish, some of which weighed 400 pounds each (see p. 83). We found them acceptable sea food and equal to halibut or salmon of more northern waters.

Some of the pelagic fishes, such as the skipjack, bonito, and mackerel, caught on a troll behind the vessel, rank among the most beautiful creatures of the sea; the rainbow colors of the bonito particularly cannot be excelled for beauty by any dweller of more tropical waters.

In winter the spiny lobster is caught in abundance off the shores of Cedros and shipped to San Diego, Los Angeles, and San Francisco. The "pots" or traps were in evidence at almost every landing we made. The supply in California has been greatly reduced through overfishing, and it is hoped that Mexican regulations will be made sufficiently stringent to furnish a constant supply from Lower Californian waters.

SEA-LION COWS RESTING UPON AN OUTLYING ROCK OF EAST BENITO ISLAND

MANY INTERESTING ANIMALS FOUND ON CEDROS ISLAND

There are many interesting species of land animals on Cedros Island. Deer, rabbits, and several kinds of wild rats and mice are to be found; also rattlesnakes, gopher snakes, several kinds of lizards, and a tree-frog. Goats, cats, and dogs have been liberated on this island, too, and they have turned to the wild state, but have not yet become common.

The cats will have a much more difficult time here than on Guadalupe, because birds are scarce and they are extremely wild and wary.

East Benito, West Benito, and Middle Benito lie close together, about 15 miles west of Cedros. Fur seals, elephant seals, and sea otters were once found here in abundance, but a few bones of the elephant seals were the only traces of them remaining. California sea lions, however, were abundant. These barking animals, familiar to the patrons of circus and vaudeville as "trained seals," were found on every island we visited.

These animals are being put to no commercial use at present; therefore protective legislation is not immediately needed. For this reason it would be much easier at

EVEN THE HARDY CACTUS CANNOT EXIST IN THIS PART OF CEDROS ISLAND

THE GIANT CACTUS OF SANTA MARGARITA ISLAND

The fruit of this species is delicious. It can be seen as small knobs on the upper ends of some of the branches. The truck shown in the illustration was used during the World War for hauling magnesite from the hills in the background to the boat landing, whence it was shipped to the United States for use in smelters (see text, page 99).

this time to pass laws which would effectively protect the animals from extermination, should an industry be developed.

The characteristic plants of the San Benitos are cacti, of which there are several species. One of the most annoying is the vicious cholla (pronounced chòya), the barbed thorns of which are as sharp as the sharpest needle and are very difficult to extract, once they have penetrated the skin.

Cats have also been liberated on all of these islands, and they have worked havoc with the birds. McGregor's house finch was a form found in no other place, but it has been practically exterminated; we saw but a single individual where a few years ago there were hundreds.

We found a crew of Japanese on West Benito Island industriously gathering and drying abalones. They had brought their fresh water from San Diego, 200 miles away.

AN OSPREY'S NEST IN A GIANT CACTUS

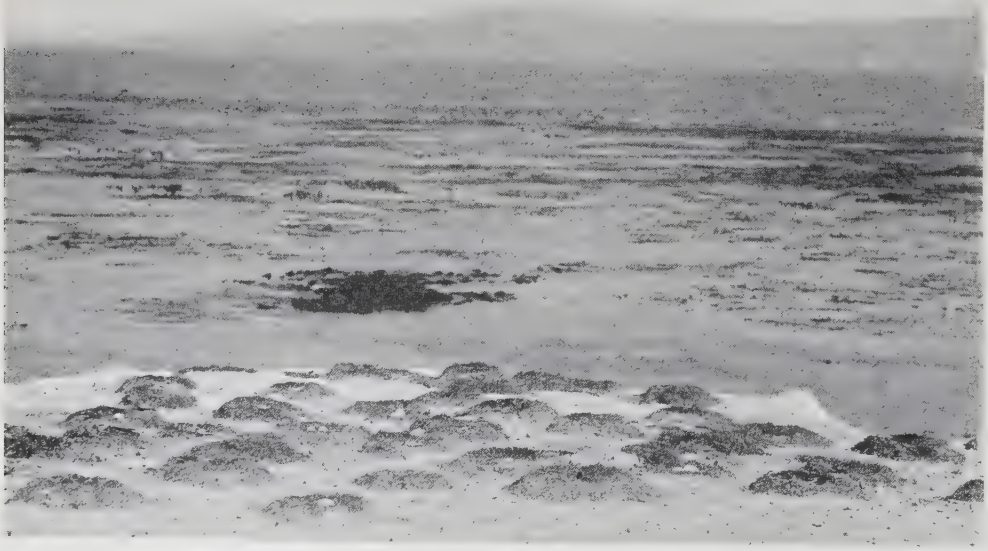
Locations for nesting sites on the desert islands off the coast of Lower California are at a premium, and on Santa Margarita Island many giant cacti suitable for holding the bulky structures of the osprey are occupied. Each year the nests are supplied with more sticks and rubbish until, in some cases, the cactus breaks under the weight.

Some years ago it was discovered that three species of petrels—least, black, and Socorro—nest in burrows on the San Benitos. The discovery produced a mild sensation in ornithological circles, because previously the first of these species had been scarcely known to science.

This little bird, hardly as large as the English sparrow, has never been found nesting elsewhere, but there are thousands of them on these islands in the breeding season. They fly by night and kept up a continual chatter over the *Tecate* as it lay at anchor. Occasionally one would be blinded by one of our lights and fly to it like a moth. During the day they remained either in their burrows with the single egg or chick or far at sea. They are wide-ranging fliers like the albatrosses, to which they are related. The sailor calls them sea swallows.

There are no indigenous land mammals on the San Benitos, nor are there any snakes, and we found only a single species of lizard. Insects and land shells occur in abundance. The latter were first made known to the world through the visit here of the officers of the British survey ships

CORMORANTS ON ASUNCION ISLAND: EACH WHITE SPOT ON THE HILLSIDE IS A NEST



SHALLOW CORMORANT NESTS ON SAN ROQUE ISLAND

Every available piece of movable vegetation is used in constructing these nests, and sea weeds and feathers are used as supplementary building material. The nests are arranged in large, compact groups for protection from the marauding gulls.

YOUNG FARALLON CORMORANTS ON NATIVIDAD ISLAND

Pandora and *Herald,* between 1845 and 1851, and the shell was named *Helix pandoræ.*

NATIVIDAD, SAN ROQUE, AND ASUNCION ISLANDS

Situated eight miles south of Cedros Island, Natividad partakes of many of the characteristics of its larger neighbor. On the other hand, there are many striking contrasts. There are no indigenous land mammals except a white-footed mouse; snakes are absent, but there are two species of lizards. There are no trees and little brush, but the giant cactus stands, sentinel-like, on many of the higher parts.

San Roque and Asuncion Islands are much smaller and are a few miles farther south. All three of these are essentially sea-bird islands. Gulls, cormorants, and pelicans nest here by thousands and much of the land is white with guano. A considerable amount of this fertilizer has been shipped, and it is said that boats occasionally come for cargoes from Gulf of California ports. The chief use of the islands, however, is as landing places for the lobster fishermen.

From our observations the sea gull, of which poets sing, does not deserve all of the fine things which have been said about it. These birds are guilty of much depredation upon the rookeries of the cormorants, which build their nests close together, the black groups at a distance appearing like islands on the background of white guano (see page 85).

Evidently the cormorants derive a certain amount of protection through this close association of large numbers, because the gulls do not molest them to any great extent so long as they are left undisturbed. But when the cormorant rookery is disturbed, the gulls take advantage of the opportunity and pounce upon the nests, killing young birds and breaking eggs by the hundreds. They can eat or carry away only a fraction of the chicks and eggs they destroy.

Walking on the uplands of these islands is difficult, for one is constantly breaking through into the tunnels or burrows of black-vented shearwaters. These birds also belong to the family of albatrosses, and, like their relatives, roam far and wide over the sea; yet they invariably

THE UPTILTED SEDIMENTARY STRATA ON CEDROS ISLAND

These rocks are of great age and their position indicates the tremendous geological disturbance which occurred here in times past.

EQUIPMENT FOR DRYING ABALONES ON WEST BENITO ISLAND

The mollusks are first cooked in boilers, then spread on the wire frames to dry in the sun.

AN ELEPHANT TREE ON CEDROS ISLAND

This desert species seems to thrive as well in such inhospitable places as on the valley floor. Its clusters of beautiful pink flowers are in strange contrast to the grotesque shape of the trunk (see text, page 87).

return to these particular islands to rear their young.

Most of them had left the burrows at the time of our visit and we saw flocks of tens of thousands in the sea a little to the south.

At the eastern end of Asuncion Island is a precipitous, flat-topped rock occupied by sea lions and birds. Beetles were exceptionally abundant on the tableland and the specimens which we collected have been enthusiastically studied by entomologists since our return. Since the rock is without a name on available charts and one is needed to designate it in the technical reports, we propose that it be called Angulo Rock, after the genial captain of the *Tecate*.

TWO ISLANDS GUARD ONE OF THE WORLD'S FINEST HARBORS

Magdalena and Santa Margarita Islands form the outer barrier to Magdalena Bay, one of the most beautiful harbors in the world. It is deep, wide, and unobstructed at the entrance and has sufficient room for all the navies of the world to swing with the tide. Storms are practically unknown

BROWN PELICANS IN FLIGHT

Although these birds appear awkward on land and in diving for fish, they are the epitome of grace on the wing.

and the temperature is mild and equable throughout the year.

But Magdalena Bay has two serious drawbacks which have prevented its development: there is no adequate supply of fresh water available and the surrounding country is the most barren of deserts. It is said that there have been periods of five consecutive years without a single drop of rainfall in the vicinity. Such difficulties are almost insurmountable. Nevertheless, a few people eke out a precarious existence here.

DYE LICHENS ONCE GATHERED HERE

Magdalena Bay village was formerly headquarters for a company engaged extensively in gathering a species of lichen called orchella, from the country round about. The lichen grew upon other plants, in festoons and bunches, somewhat like the Spanish moss of our Southern States. It was baled and shipped chiefly to Germany for the manufacture of dyes, but the development of the coal-tar colors has destroyed the orchella industry.

On Margarita Island there is a fishery by-products establishment engaged in the manufacture of fertilizer and oil from a small species of herring found most abundantly in the bay. Employment is given to perhaps 30 people.

And on the seaward side of this island a Mexican family was found living very close to nature, on what they called their ranch. It was difficult to understand how they managed to subsist under such trying conditions. The Eskimo of the frozen zone has a paradise by comparison. Subsurface fresh water had been obtained from wells, but it was so salty we could scarcely drink it.

These islands are separated from the mainland by narrow lagoons which are bordered by impenetrable mangrove swamps. Wood-rats build their bulky nests in the mangroves like squirrels, and crabs swarm and rattle their claws on the mud beneath.

SUNRISE ON THE ROCK-BOUND SHORES AT THE SOUTHERN END OF CEDROS ISLAND

Although the nights are pleasant, the sun beats down mercilessly on the barren desert at noontime, and there is seldom a drop of rain in this part of the world.

In these swamps we found Xantus jays and the rare and beautiful mangrove warblers. Great black moths flitted here and there over the bushes, while herons and egrets perched nonchalantly on projecting stubs.

A TROPICAL SETTING

Out in the bay the brown pelicans were constantly diving in an endeavor to satisfy insatiable appetites, while high over head man-o'-war birds were coming and going, with the ends of their journeys dark secrets, as far as we were concerned. All of this produced a tropical setting such as we had not experienced elsewhere on the cruise.

The land animals of these islands consist of jack rabbits, coyotes, rats, mice, rattlesnakes, and lizards of several species—rather an uninteresting array except to the specialist. To him the desert conditions have produced many modifications which are striking. On Santa Margarita, for instance, the jack rabbit has become very dark in color, just the contrary to what one usually associates with such situations.

Cacti form the main element in the vegetation, and there are many striking species. On Santa Margarita there is a fine forest of the giant species and many of the trunks reach an altitude of 60 feet. The fruits were just ripe when we were there, in July, and the woodpeckers and cardinals were having a great feast. We tried the fruit and found it most delicious and an excellent thirst-quencher. In taste it suggests a finely flavored black raspberry and is about two inches in diameter. The forest grows on the seaward side of the island chiefly, where there is fresh water at no great depth (see pp. 90, 91).

Other desert vegetation grows here in exceptional luxuriance. One of the most striking species is a wild cotton, found in some of the canyons; it has a bright yellow flower, but very little "wool."

In the hottest part of the interior of Santa Margarita Island we captured a desert iguana, a species of lizard which tucks its fore legs against its chest and, with tail high in the air, runs with the speed of a race horse. It was so hot from the sands that it could scarcely be

Photograph by Neil M. Judd

EXCAVATED SOUTHEAST SECTION OF PUEBLO BONITO AT THE CLOSE OF THE 1922 SEASON, SEEN FROM THE NORTH CLIFF OF CHACO CANYON

The National Geographic Society Expedition camp is seen at the upper right. The excavated eastern section of Pueblo Bonito, at the close of the 1922 season, disclosed an orderly arrangement of rectangular dwellings and round ceremonial rooms. Note the men at the right and the steel dump cars that conveyed the débris to the arroyo.

held in the hand, yet it seemed to suffer no discomfiture whatsoever.

The greater portion of these islands is steep and rocky. On Santa Margarita is a considerable quantity of magnesite, which during the World War was gathered and shipped for use in the iron and steel industry; but operation ceased when the urgent need for the material passed.

Magnesite is scattered far and wide in this region, in the form of nodules.

From Cedros and the San Benito Islands southward there is evidence of a general subsidence. Marine shells were found at elevations up to 50 feet and in great abundance at many places, yet there was no evidence of an old or long-continued beach-line. It would seem that this entire region has been "soused" beneath the sea for a short time not very long ago.

Farther south the land went under to a much greater depth, because terraces of shells have been found at elevations of more than 1,000 feet. Certainly the geological changes of the region have been most sudden and violent in character.

No doubt they have had a profound influence upon the present distribution of the animals and plants of the region.

PUEBLO BONITO, THE ANCIENT*

The National Geographic Society's Third Expedition to the Southwest Seeks to Read in the Rings of Trees the Secret of the Age of Ruins

By Neil M. Judd

Leader of the National Geographic Society's Pueblo Bonito Expeditions

THE visitor to Pueblo Bonito invariably asks, first of all, How old is the ruin? And it is precisely this question, unfortunately, which remains the most difficult to answer.

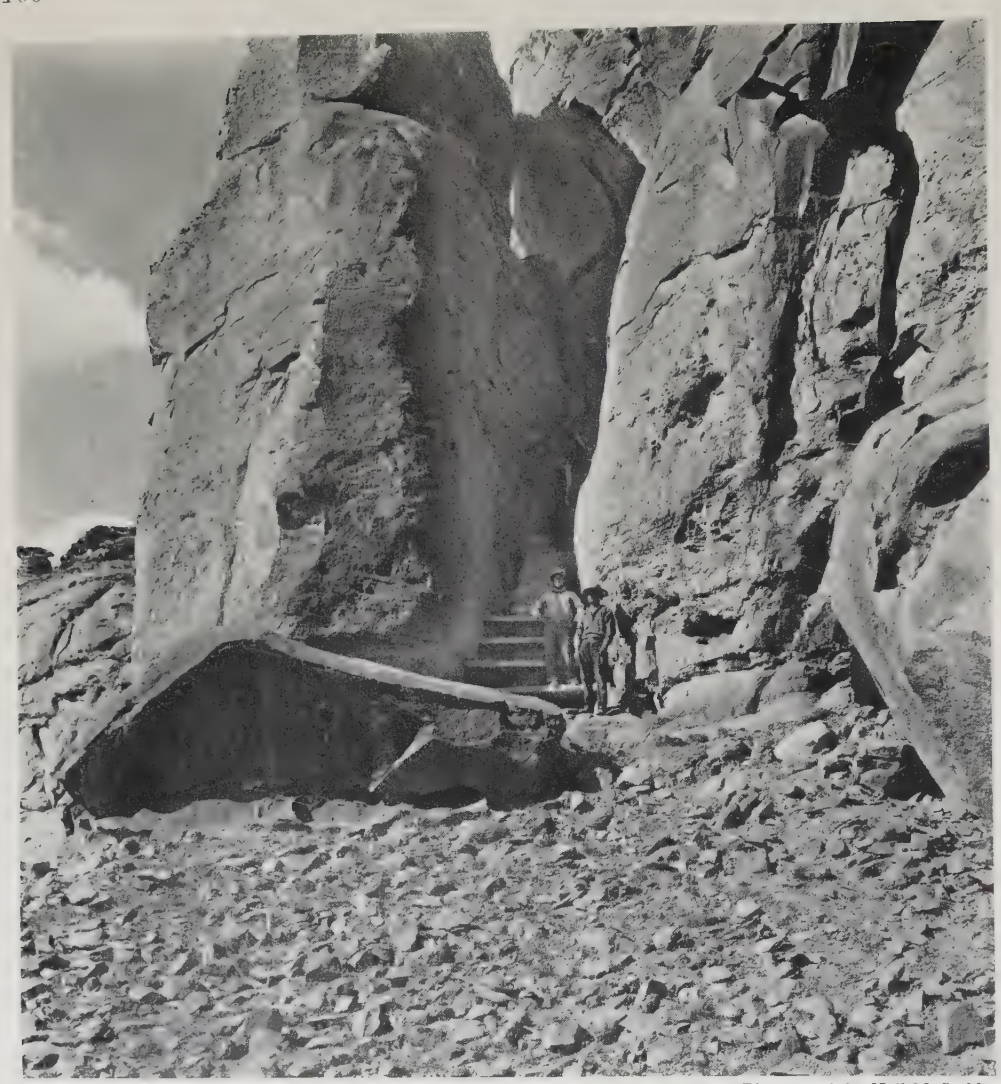
It is possible to identify many of the antiquities recovered and to explain the purposes for which they were originally designed; it is possible, and with reasonable accuracy, to sketch the picturesque life that once brightened these now drab walls of stone and clay and made the "Beautiful Village" an objective for venturesome merchants, with their wares from places so distant, even, as the valleys of central Mexico; it is possible to read from the strata of silt which have built up the valley floor something of the struggle waged by these ancient agriculturists against the overwhelming forces of Nature in desert surroundings; but it is not yet possible, and may never be, to count the years that have passed since that struggle was lost and the once proud Bonitians moved on, perhaps with heavy hearts, to greener hillsides and happier homes elsewhere.

THE SECRET OF AGE IS WELL GUARDED

Pueblo Bonito guards her age well! The casual observer would unhesitatingly say that no great period of time could have elapsed since this prehistoric apartment-house was abandoned; that walls of mere mud and stone could not have stood against the elements for more than a relatively few years.

Such superficial opinions fall by the way, however, when the explorer turns his microscope of inquiry upon the ancient structure. Then, and only then, are the evidences of considerable antiquity revealed—archaic pottery and other utensils peculiar only to the prehistoric Pueblo peoples of the southwestern United States; utter lack of any object commonly associated with European civilization and,

* See the announcement of the Pueblo Bonito Expedition in the National Geographic Magazine for June, 1921, and the account of the 1921 Expedition in the issue for March, 1922. The third Expedition left Washington for Pueblo Bonito May 1, 1923.



Photograph by Neil M. Judd

ANCIENT STAIRWAY LEADING TO PUEBLO ALTO, ON THE CLIFF ABOVE PUEBLO BONITO

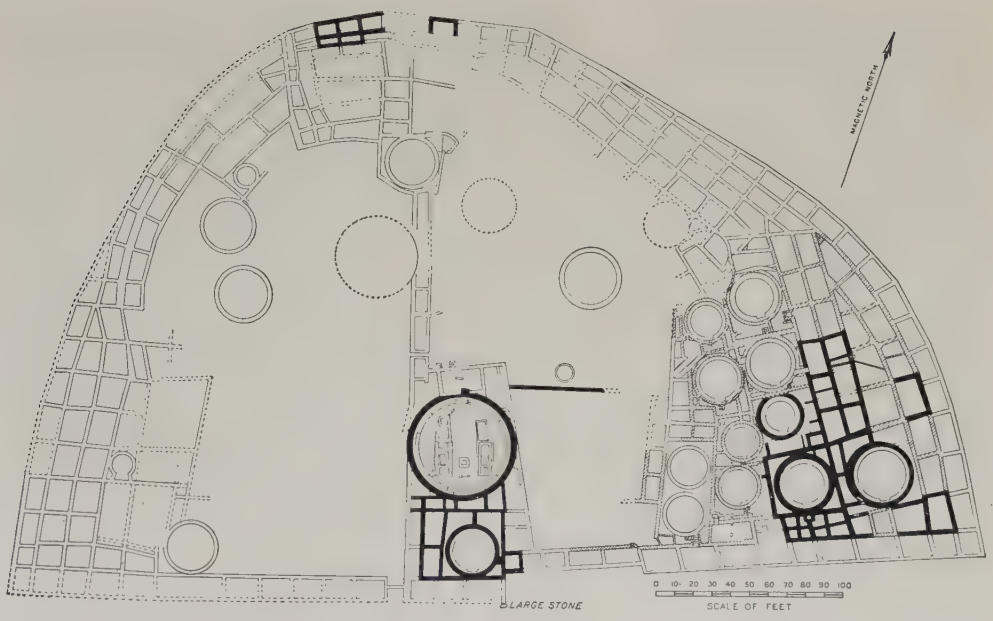
The planks at the foot occupy deep grooves in which the Bonitians had placed similar timbers, hewn by stone axes. The ancient Bonitians reached the top of the north canyon wall through a narrow crack in which they had placed broad wooden steps. A visiting member of The Society supplied new timbers, the old stairway has been restored, and the ascent may now be made without danger.

most convincing of all, the vast depth of wind-blown sand and other débris that has accumulated in and about the building since it was deserted.

During those turbulent 16th century years when the Aztec and other Mexican tribes were feeling the merciless force of the Conquest, the Spaniards heard recurrent tales of terraced villages far to the north—villages whose streets were paved with gold and whose doorways were studded with precious stones. There were seven of these wondrous cities, all ruled by a single super-chief or lord; their reputed fabulous wealth proved irresistible to the conquistadores.

SEARCHING FOR THE "SEVEN CITIES OF CIBOLA"

Late in March, 1539, Fray Marcos di Niza set out in search of these mysterious villages and when he came finally within



From original drawing by Neil M. Judd

GROUND PLAN OF PUEBLO BONITO SHOWING THE PROGRESS OF NATIONAL GEOGRAPHIC SOCIETY EXCAVATIONS

The solid black lines indicate the extent of The Society's 1921 explorations, and in hachured lines the excavations of 1922. Traces of earlier dwellings found beneath the floors of Pueblo Bonito are not shown. In the round kivas secret ceremonies were held and preparations made for the public dances in the two open courts.

sight of the Zuñi pueblos and their cultivated fields he believed he had found the "Seven Cities of Cibola" and hastened back to Mexico to confirm the native recitals and even enlarge upon them.

The conquest of this New Spain, our own Southwest, began almost immediately and has continued ever since.

Although but little doubt now remains that the Mexican Indians had the Zuñi towns in mind, there are legitimate reasons for believing their tradition of the seven northern cities was an old one whose origin lay in glittering stories of Pueblo Bonito and its neighboring villages—tales brought back by parrot venders from lower Tamaulipas or even Oaxaca.

Coronado and his mailed followers overlooked but little—they boldly penetrated east, north, and west into unknown desert regions—but no convincing record has yet been found in their journeys that they saw, or even heard of, the marvelous ruined settlements of Chaco Canyon, in northwestern New Mexico.

We must infer, therefore, that the noncommittal Zuñi and other sedentary peoples subjugated by the strange "white gods" had either forgotten or chose to conceal from the Spaniards all knowledge of the incomparable prehistoric pueblos of the Chaco. Their history is as yet unwritten; their decline and ultimate abandonment had occurred, no doubt, long before the venturous Norse paddled their miniature vessels to the discovery of America.

BONITIANS HAD NO METHODS OF RECORDING TIME

Archeologists studying the pottery and other cultural remains, geologists examining the valley deposits and eroded cliffs, dendrologists peering into the lifelong secrets of dead and dying trees, have each, working independently along definite lines of inquiry, estimated the abandonment of Pueblo Bonito as about 1,000 years ago. But this figure, although reached after careful consideration of certain material facts, is a conjecture

Photograph by Neil M. Judd

BEGINNING EXCAVATION

Before digging operations began, the usable stones from fallen walls were gathered and passed to a central point and there stored until required in repair work. Holes torn by vandals must be mended to prevent early collapse of the higher walls in Pueblo Bonito, with their incomparable masonry. Compare this view with that on page 103, which shows the same area after exploration.

merely. It fails to answer, absolutely, the question as to the age of Pueblo Bonito.

The Bonitians possessed no method of recording time that can be correlated with our own system of time measurement; they had evolved no elaborate calendar, such as had the Maya of Central America.* When circumstances urged them forth, they closed the doors to their dwellings and pushed out across the open country to regions as yet undetermined. With the passing of the centuries, their great community house became a ruin; as such we find it to-day.

Although the exact date when Pueblo Bonito was first established and the year when it was finally abandoned remain, for the present at least, unsolved problems, there is a dim hope that these points, these all-absorbing questions, may eventually be answerable.

* See "The Foremost Intellectual Achievement of Ancient America," by Sylvanus Griswold Morley, in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1922.

Within the past decade archeological investigations elsewhere in the Southwest have resulted in a system of relative dating through pottery sequence—the comparison of different types of pottery vessels; but this method, useful as it is, only gives us the approximate age of any given ruin in relation to other ancient structures of similar characteristics.

TIMBERS MAY PROVE KEY TO MYSTERY OF THE AGE OF RUINS

Relative dates are not wholly satisfactory, even to the archeologist, and they are much less so to the layman. It remains to be determined, therefore, whether any other possible means may exist for correlating the chronology of this prehistoric culture with that of our own civilization. Such a means is now being sought by the National Geographic Society's Pueblo Bonito Expedition and by a very novel method.

The oldest living things in America are its big trees, the sequoias of the Sierra

Photograph by Neil M. Judd

INDIANS STANDING AT NORTHEAST CORNER OF ONE OF THE PUEBLO BONITO KIVAS

The mud plaster still adheres to some of the inner walls (see also page 102).

Nevada.* The pines and junipers of Arizona and New Mexico are much younger than the sequoias; but, like the latter, they are older than any other living thing in their own neighborhood. Some of these upland trees are between 400 and 500 years of age, and it is not at all improbable that still older ones may be found.

The life history of almost every tree is revealed by its own cross-section, each year's growth being recorded by a new ring. If any given year has been one of scanty rainfall, the particular ring for that year will be relatively thin; and, conversely, if the rainfall has been abundant, there will be a corresponding increase in the thickness of the annual ring.

Periods of drought or excessive moisture, it has been learned, tend to repeat themselves at fairly regular intervals, resulting thus in a more or less orderly sequence of thick and thin annual rings which do not vary, to any marked degree, in all the trees of any one district.

Certain of these ring series possess individual features that quickly identify them, no matter in what locality they may be found, and these are naturally utilized by the investigator as "keys" to the problem he is seeking to solve. And what is true of living trees is likewise true of dead

* See the NATIONAL GEOGRAPHIC MAGAZINE for January, 1917, and July, 1921.

PART OF THE EXCAVATED SECTION OF PUEBLO BONITO AT THE CLOSE OF 1922 SEASON

When several trainloads of building stone, adobe, plaster, and wind-blown sand had been carted away and the frayed edges of walls repaired to prevent rain water running into the empty rooms, Pueblo Bonito began to assume definite form and character.

Photographs by Neil M. Judd

A FIREPLACE, CEREMONIAL ENTRANCE, SOUTH BENCH RECESS AT PUEBLO BONITO

Beneath the floor of this shattered kiva, or ceremonial room, of pure Chaco Canyon type, lay the partially razed walls of an earlier kiva of entirely different design. The Indian boy stands on the floor of the earlier room; his head is at the floor level of the later structure.

Photograph by Neil M. Judd

ONE OF THE FEW FIREPLACES DISCOVERED WITHIN THE ROOMS OF PUEBLO BONITO IS DIVIDED BY THE SHADOW ABOVE THE WORKMAN'S TROWEL

The Bonitian housewife did the family cooking in the village court or on the roof of her neighbor's home.

trees, and beams or roofing timbers from prehistoric ruins, like Pueblo Bonito.

From the foregoing it will be obvious that if any overlapping series of annual rings can be discovered—that is, if a given sequence of rings can be found both in a beam from Pueblo Bonito and in a tree still living—it will be possible to date the former with reasonable exactness.

Such a direct connection, however, with no intervening links in our time chain from the beams of prehistoric Pueblo Bonito to the living trees of northern New Mexico, is rather beyond the range of possibilities; the explorer's task is rarely quite so easy as that.

TRYING TO BRIDGE A TIME GAP

It seems necessary, therefore, in the present case, to find a "connecting link" in this time chain, and that is the especial object of a subsidiary expedition recently authorized by the Research Committee of the National Geographic Society in connection with the exploration of Pueblo Bonito, now in its third year.

This party will seek out the oldest living trees in the plateau States; it will seek dead pines and stumps which have been buried in mesa canyons, hoping through them to bridge the gap that now guards the age of the great ruin. And, with equal confidence, the party will search Pueblo villages still inhabited for roof beams that may have been cut several centuries ago.

Prior to the conquest of 1540, Pueblo artisans felled with stone axes the timbers that went into the construction of their terraced homes. So great was the labor involved in cutting and transporting these logs that they came to be looked upon as prized possessions and were frequently carried along when family groups abandoned one village in favor of another, newly established.

Because of this known practice it is not unlikely that beams still utilized at Zuñi, Walpi, and other pueblos reconstructed at the close of the 17th century were salvaged from dwellings destroyed following the "Pueblo rebellion" of 1680.

Such timbers, if indeed they exist, will

Photograph by Neil M. Judd

REMAINS OF THE CEILING OF ONE OF THE ROOMS AND WALL SUPPORTS OF PUEBLO BONITO

The logs, split cedar, and adobe mud that formed the upper floors in Pueblo Bonito have mostly disappeared, but such beams as are found may help to determine the age of the ruin when their annual ring growth is studied (see text, pages 103 and 105).

surely lessen the gap that now separates the ring-growth series of Pueblo Bonito beams from that in living pines on the higher mesas of Arizona and New Mexico.

Cross-sections from forty-nine timbers unearthed during the explorations of 1921 and 1922 have been examined by Dr. A. E. Douglass, of the University of Arizona, with very instructive results. These beams, taken from the eastern portion of Pueblo Bonito, all seem to have been cut within a period of twelve years.

Some timbers exposed in the northwestern quarter of the ruin, however, were cut several years earlier, thus corroborating the archeological evidence previously presented.*

Dr. Douglass tells us, also, that most of these ceiling beams were felled in winter or very late autumn. It may be, therefore, that the ancient Bonitians had periodic logging parties; that, after the harvests had been gathered and safely stored away in the interior rooms of the village, groups of the menfolk set out for the timbered ridges in search of logs with which to roof new dwellings.

Lacking beasts of burden, they dragged or carried on their backs the large beams we find to-day in Pueblo Bonito and Pueblo del Arroyo.

DID FORESTS ONCE GROW IN NOW DESERT CANYONS?

What has happened out there in the desert canyons of New Mexico during the past thousand years?

Were former forests exhausted in the construction of the "Beautiful Village," or has the climate so changed with the passing years as to have blotted out these forests and to have checked all subsequent attempts of Nature to replace the trees that were?

The fact remains that no timber comparable in size to the ancient beams grows to-day within 40 miles of Pueblo

* See the NATIONAL GEOGRAPHIC MAGAZINE for March, 1922.

Photograph by Neil M. Judd

ON THE CLIFF ABOVE PUEBLO BONITO, MAPPING CHACO CANYON

It was a trying task to prepare an accurate map of Chaco Canyon, for down on the valley floor the heat was intense and up on the broken rim rock tireless winds threatened to brush both surveyor and transit over the edge. Capt. R. P. Anderson and two Indian flagmen completed the undertaking, nevertheless. For comparison, note the size of the horses in the right foreground.

Bonito, and that a period of unknown length has elapsed between the cutting of the last roof-beams in Pueblo Bonito and the sprouting of the seedlings which have since become the oldest known living trees of the Arizona and New Mexico plateaus.

Exploration of Pueblo Bonito has disclosed other evidence which points to the great antiquity of the village. The partially razed walls of earlier structures lie beneath the foundations of nearly every room thus far excavated; these earlier dwellings appear to have been erected on a knoll or slight elevation which has long since lost its identity, owing to the millions of tons of blown sand and water-deposited silt that have gradually built up the level floor of Chaco Canyon since the ancient towns were occupied.

Human habitations vastly older than Pueblo Bonito—houses covered by as much as 12 feet of clay and sand—within

a few moments' walk of the great ruin have been discovered and explored by the Expedition.

These remains, together with deeply buried layers of potsherds, charcoal and other camp refuse exposed by cutting of the arroyo, illustrate the fact that Pueblo Bonito, old as it unquestionably is, was not established until long after primitive man had selected this isolated desert canyon as a desirable spot in which to locate his home and family.

PUEBLO BONITO WAS A COÖPERATIVE SETTLEMENT

The explorations of 1922 emphasized even more strongly than did those of the previous summer the fact that Pueblo Bonito is a monument to the coöperative efforts of peoples physically related, though culturally distinct, who were drawn together, through mutuality of interest, from widely separated localities.

Cliff-dwellers from the picturesque cave villages of Colorado's Mesa Verde were welcomed by the Bonitians, together with migrating clans from the valley pueblos that once bordered the Little Colorado River in Arizona. Relics peculiar to each of these distinctive cultures abound in Pueblo Bonito, whose characteristic arts were influenced, though not supplanted, by such foreign elements.

Many mysteries in connection with Pueblo Bonito remain still to be solved. One of the most tantalizing of these has to do with the manner of disposing of its dead, on which depends certain fundamental truths.

Excepting two discarded wisdom teeth and the body of an infant, buried in the refuse which filled an abandoned room, no skeletal material has yet been found by the Expedition, although hundreds of individuals must certainly have died during the long-continued occupancy of the village.

THE PROBLEM OF THE WATER SUPPLY

Another puzzling problem concerns the source and extent of the ancient water supply. Primitive man can exist very well on a quart or two of water a day for culinary purposes, but Pueblo Bonito had a thousand or more inhabitants, and other neighboring settlements were undoubtedly dependent upon the same springs or reservoirs.

The broad stairway behind the ruin may have led to sand-scoured water pockets on the cliff above, pockets that still hold water for short periods following the early spring and midsummer rains. But what seems even more likely is that once generous springs at the base of the canyon wall have since filled and been covered over with blown sand to such an extent that their exact location is no longer apparent.

Aged Navajo warriors still dwelling in Chaco Canyon insist that, as boys, they heard the old men of their tribe tell of one such spring which formerly issued from the rocks near Ysa-be-ad-ne-i (Place-where-the-rock-is-braced-up).

Explainers of the Great Mysteries, believers in self-fashioned solutions of natural phenomena though they be, the Navajo may possess more information regarding prehistoric Pueblo Bonito than it has been possible to concede heretofore, and their folklore merits our careful consideration, since it may yet prove unexpectedly helpful in solving pertinent problems which now seem well-nigh hopeless.

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OUR HERITAGE OF THE FRESH WATERS

Biographies of the Most Widely Distributed of the Important Food and Game Fishes of the United States

By Charles Haskins Townsend

Director of the New York Aquarium

With Sixteen Color Plates from Paintings by Hashime Murayama

SINCE the beginning of time mankind has been able to get some part of his food from the waters; among the relics of the Stone Age are shell hooks and stone sinkers. Ancient sculptures—Assyrian, Egyptian, and Aztec—portray the taking of fishes with spear, hook, and net.

The prophet Habakkuk—who knows how many centuries B. C.?—placed some details on fishing in the earliest literature: "They take up all of them with the angle, they catch them in their net, and gather them in their drag."

In some of the far corners of the world amazingly primitive ways of getting fishes are still in use.

In the mountain streams of New Guinea the still-savage native has been found using a dip net made of a hoop fitted with a piece of unbelievably tough spider web.

We have seen the Aleut drag up a heavy halibut with a huge hook of bent wood, the Fuegian make a successful throw with his bone-pointed spear, and the Tonga islander stupefy hundreds of fishes with the juices of a poisonous plant.

The modern Japanese fisher has not yet lost the ancient art of making the cormorant fish for him without the trouble of providing either hook or bait.

As populations increased and man improved his methods, he naturally took more food from the waters and doubtless wasted more; and this he is still doing. His equipment is now enormous and a surplus fish supply often gluts the market, despite cold storage and other means designed to prevent it.

As fish-catching enterprises gradually became great fishery industries, there arose the problems of diminishing supply. The sea fisheries stood the strain so well that some naturalists of the past generation took the stand that the puny efforts of man could not affect the life of the sea; but this view has undergone a change. To-day there are official boards in many countries concerned with the preservation of sea fisheries.

OUR FRESH-WATER FISH RESOURCES ARE CONSTANTLY DIMINISHING

In considering the resources of our fresh waters, we find everywhere exhaustive methods of fishing and a diminishing supply, in spite of restrictive measures and extensive fish propagation.

The means by which diminution is measured are to be found in the fishery statistics of the past half century. The annual yield of products—still very large—can be safely viewed only in com-

FISHING IN SKYKOMISH RIVER NEAR INDEX, WASHINGTON

There are several kinds of Trouts in the waters of Washington State, mostly the "Cutthroat" forms, which are more numerous in the Rocky Mountain region.

Photograph by Eugene J. Hall

FISHING BELOW GOAT ISLAND, NIAGARA FALLS

The Great Lakes constitute a vast inland reservoir of fish life, the annual commercial catch sometimes exceeding 100,000,000 pounds.

parison with the continual increase and improvement in the apparatus of capture.

It takes more and more gear to make the same catch. In the Great Lakes, our largest reservoirs of fish food, the investment in the fishery industry now exceeds $10,000,000. The principal fish-catching devices, such as pound nets, fyke nets, and gill nets, practically automatic in operation, are filling day and night as long as the Lakes are free from ice.

The rivers and lakes of the United States have fishery resources that are unequaled elsewhere. The Great Lakes are virtually inland seas and the navigable rivers are among the largest in the world. The mighty Mississippi, with its tributaries reaching in all directions, fairly dominates the map of the country.

These waters, with the rivers of the Atlantic and Pacific coasts and many lakes of the Northern States, have been enormously productive in food for our people.

In one year commercial fishermen alone have taken from the Mississippi River

Photograph by Scenic America Company

FISHING IN CRATER LAKE, CRATER LAKE NATIONAL PARK, OREGON

There were no fishes in Crater Lake until Rainbow Trout were introduced by the Government. Crater Lake is six miles long, four miles wide, and in one place 2,000 feet deep. Its surface is 6,000 feet above sea-level, its steep walls rise from 500 to 2,000 feet above its surface, and it has neither inlet nor outlet.

and its tributaries more than 96,000,000 pounds of fish, while the Great Lakes yielded more than 113,000,000 pounds.

Large as are the food supplies of these two regions at the present time, they must have been vastly greater before the exploitation of their resources began. Unfortunately, there are no official records by which the extent of the earlier fishery operations may be measured.

While the fish food derived from our fresh waters is vast in quantity, it is also notable in variety. There are many kinds of Trouts, Salmons, Whitefishes, Sturgeons, Pikes, Basses, Sunfishes, Perches, Catfishes, the Shad and the Eel, as well as the less important, but abundant and widely distributed, Chubs and Suckers.

SERIOUS INROADS BEING MADE ON SALMON AND SHAD

Although the Salmons, Sturgeons, the Shad and other fishes ascending rivers for the purpose of spawning do not remain permanently in the fresh waters, it is here only that they reproduce and may be captured. It is here that they will be preserved indefinitely or utterly destroyed.

None of the rivers of the Atlantic coast contain to-day the great runs of Shad, Sturgeon, and Salmon for which they were noted half a century ago. Along the Pacific coast from California to Alaska the Salmon rivers have been subjected for more than a generation to commercial fishing so exhaustive that the prepared products are distributed by the shipload throughout the civilized world.

In the larger Pacific rivers the migrating Salmons pass up to their spawning grounds more than a thousand miles inland only after the nets of the canneries have taken their heavy toll, amounting to the great bulk of the migrants. The fresh-water crops planted by nature are being gathered at a rate that tends to increase rather than diminish.

When restrictions are proposed by conservationists, the extent of the "investment" is at once pointed out and greater propagation is urged instead. It is difficult to check a going industry, even when it is clear that its future is being imperiled.

The average citizen sees but little of the great fishing operations going on perpetually. The innumerable gill nets, pound nets and fyke nets—all under water and out of sight—work while the fishermen are asleep. From early spring until late autumn they are emptied daily and the heavy catch distributed to the markets of the whole country. In winter the markets continue to supply great quantities of fish withdrawn from cold storage.

We think little about where our fish supplies come from so long as we have them, and Uncle Sam's statistics, even when recording the annual catch in such figures as hundreds of millions of pounds, are but dull reading. It is well to be reminded, however, that the yield of the fisheries grows smaller—not larger.

In addition to the familiar food and game fishes, our waters are rich in Minnows, Darters, Shiners, and other small fry of no direct economic value, but of vast importance as the food supply of larger fishes. Every great watershed has its peculiar forms of these, all well known to ichthyologists, who have described and named them by the score.

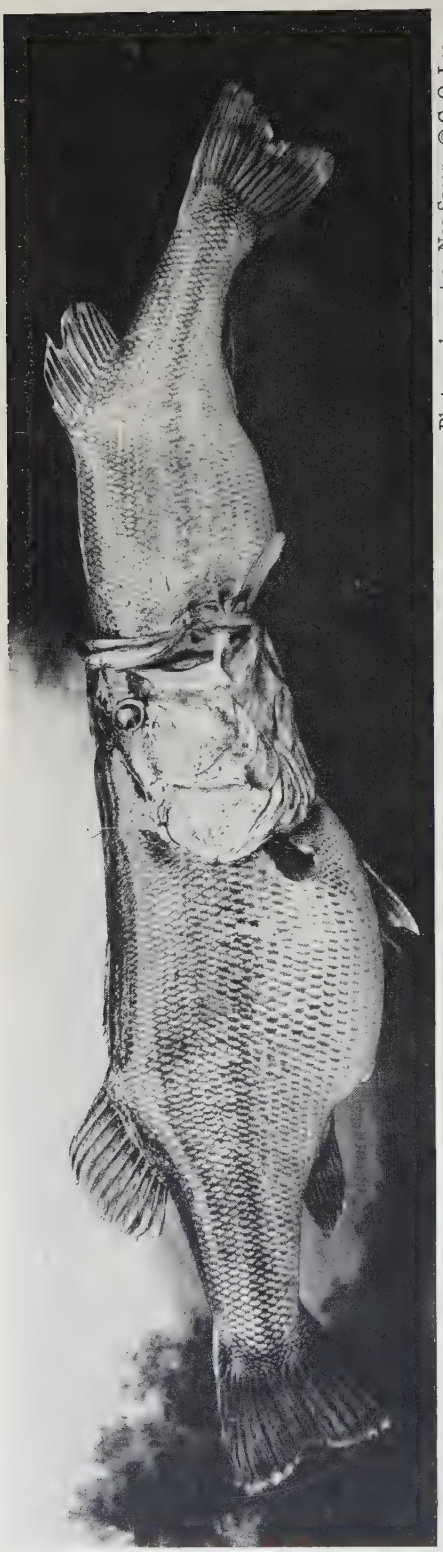
Some of our smallest fishes have been found useful in combating malaria and annoyance caused by mosquitoes, and are even being shipped by the United States Bureau of Fisheries to mosquito-plagued foreign countries. There is now in progress much active investigation regarding the value of several species of fishes for the control of the mosquito.

UNITED STATES HAS FIVE TIMES AS MANY KINDS OF FISHES AS EUROPE

The richness of fish life in our fresh waters is amazing. The United States has a smaller area than Europe, yet it has nearly five times as many kinds of fresh-water fishes. We have about 585 species of these, while Europe has but 126 species.

We find that a single State may have considerably more than 100, the number known to Illinois being 150, while New York is credited with 141. It could doubtless be shown that our fresh-water fishery resources are greater than those of any other country.

Many of the fishes commonly taken for food or in sport fishing, and naturally of wide distribution, have, as a result of fish-cultural operations, been established in sections of the country far removed from their original habitat.



Photograph courtesy Noa Spears, © C. O. Lee

A CANNIBAL BASS FALLS A VICTIM TO HIS APPETITE

These two fish were picked up by a boatman while they were still struggling in Medina Lake, near San Antonio, Texas. The large Bass had the entire head of the smaller Bass in his mouth. Hungry Bass sometimes try to swallow fishes larger than they can manage comfortably, even their own species. The cannibal shown above is the Large-mouthed Black Bass. Like the Pickerel, he can digest a particularly large mouthful by inches.

A fish belonging to the Mississippi system or to the Atlantic slope often takes full possession of a new watershed, as the result of mere transplantation of limited numbers. In this way the Shad and the Striped Bass have been made abundant on the Pacific coast—a notable success in fish propagation.

FISHING AS A LURE FOR THE TOURIST

Although the numbers of fishes caught by anglers do not figure in statistics of the catch made for market, they are not without high economic and other values. Most of the Northern States are visited in summer by tourists interested primarily in good angling waters.

Lakes far and wide have become summer resorts for people who find much of their recreation in fishing. Railways and summer resorts widely advertise the resources of their waters. Summer visitors, moving actually by hundreds of thousands, carry into these States millions of dollars. The trade in angling equipment alone is extensive.

Who can measure the health and esthetic values attendant upon the angling idea? Some one has recently asserted that the angling habit is conducive to long life, and, beginning with Izaak Walton, who lived to be ninety, presents a lengthy list of celebrated fishermen who lived well into the eighties and nineties, many of them prominent in the literature of American angling.

FISH PROPAGATION

Modern fish culture has made greater progress in the United States than in other countries, being carried on by the Federal Government and by all of the States which have fishery resources of importance. The output from Government hatcheries alone in 1921 amounted to nearly five billions of fish eggs, young fry, and partly reared fishes, while that from State hatcheries was nearly as great.

The work includes all of the freshwater fishes of importance and a

Photograph by Redner Photo Company

THE CATCH OF ONE ARKANSAS FISHERMAN—118 FISH TAKEN IN TWO NIGHTS AND ONE DAY

All the larger specimens shown here are Catfishes. There is good fishing in the streams of Arkansas; they have contributed to the markets in a single year 500,000 pounds.

Photograph by S. N. Leek

A NATIVE SON AND NATIVE TROUT: WYOMING

The Trout shown here are doubtless one of the numerous species of the Rocky Mountain region, known as Black-spotted or "Cutthroat"—probably the Yellowstone Trout (*Salmo lewisi*) inhabiting the Snake River basin above Shoshone Falls.

number of marine species belonging to the coastal regions or entering the rivers to spawn. The hatcheries, both Federal and State, are distributed north and south from coast to coast.

POLLUTION OF FRESH WATERS A DANGEROUS MENACE TO OUR FISH RESOURCES

Fresh-water fish culture in the United States has been carried on for more than fifty years in steadily increasing volume, in the effort to keep pace with a depletion by fishery industries that constantly threaten exhaustion of the fish supply.

The great fishery problem of the time in our country is the pollution of the fresh waters by innumerable agencies, rapidly affecting their productiveness. Unless stern measures are introduced by law to correct this, soon one of our great natural economic gifts will be seriously stricken.

When we consider that the market catch in the Great Lakes alone sometimes exceeds 100,000,000 pounds a year, that legions of anglers are overfishing the Trout and Bass streams everywhere, and that pollution of the rivers by manufacturing industries has reached appalling proportions, it is apparent that our heritage of the waters is endangered to a serious degree.

Fish culture alone cannot save it, even if greatly increased. We are already wasting expensive propagation work in stocking waters no longer suitable for fish life, and many streams have been abandoned to their fate. One could name a score of rivers in mining and manufacturing States, once contributing to the food supply, that now contain no living thing—no fish or Mussel or Crayfish, not even the air-breathing Frog. These rivers represent damaged resources and there are others that may soon be like them.

Reforms come so slowly that the great cleaning-up task ahead of the American people is not likely to be undertaken seriously until conditions become intolerable. In many countries all wastes available for fertilization are restored to the land and not sent insensately through sewers into the streams, while manufacturing wastes

Photograph by Harry F. Blanchard

HIS TRIBUTE OF THE DAY'S CATCH

are converted into valuable by-products. The exhaustion of our fresh-water resources through overfishing and water pollution is not inevitable. There is now a saving fund of knowledge relative both to propagation and protective measures, awaiting application through the force of aroused and insistent public demand.

THE AUTOMOBILE AFFECTS FISH SUPPLY

A more recent but increasing danger to which angling waters are exposed lies in the ever-increasing use of the automobile. Bass and Trout waters heretofore reached with difficulty have become the easily accessible resorts of camping parties, with the result that their resources are being exhausted.

As a partial offset to such conditions, we may point to the increasing efforts of the United States Bureau of Fisheries in the work of rescuing food and game fishes from overflowed lands in the Mississippi Valley, where appalling numbers of fishes have always perished upon the recedence of floods.

Although a dozen or more crews of five or six men each, equipped with seines, are now employed, many times the present number are needed. The total number

Photograph by E. R. Sanborn, New York Zoölogical Society

THE INCOMPARABLE BROOK TROUT, BEST BELOVED BY THE LIGHT-ROD FLY-FISHER

This fish thrives in cold torrents which grosser fishes do not enter. No part of our outdoor heritage is more worthy of conservation than the rapid Trout waters of the mountains.

of entrapped fishes restored to flowing waters in 1922 exceeded 179,000,000 of all sizes. The larger fishes are removed to adjacent streams, the smaller ones distributed far and wide for the stocking of depleted waters.

Many as are the sportsmen taking toll of our wild life with the gun, those who use the rod are vastly more numerous. It is as easy to exhaust a small stream by overfishing as it is to exhaust the quail supply of a neighborhood. Fortunately, the preservation of the fishes is always possible through the employment of safeguards and restorative measures. Our fishing will doubtless last longer than our shooting.

Private fish culture would be of great service in maintaining and increasing our supply of fish food. While it has been practiced for centuries in some European countries, it has but little more than commenced in America.

The possessors of strongly flowing springs, brooks, and small lakes should be awakened to the value of their home resources for water farming. Approved methods for the construction and management of fish ponds have been worked out at public fish-cultural stations and instructive public documents on the subject can be had for the asking.

Fish-culturists assert that an acre of water can be made to yield more food than an acre of land and the truth of the assertion has been demonstrated.

MUSSELS DEPENDENT UPON FISH HOSTS

An interesting work in aquiculture is now being carried on in the Mississippi Valley under the direction of the Bureau of Fisheries. It is based upon the fact that the propagation of the Mussel is dependent upon the presence of fishes to which the young, free-swimming Mussels may attach themselves as parasites until they are old enough to form shells and begin an independent existence.

The large, heavy-shelled Mussels of this region have been gathered in such numbers for the manufacture of pearl buttons, and also for the valuable pearls they sometimes contain, that the supply is being exhausted and the important industry dependent upon the Mussel is in danger.

The Mussel industry annually yields 60,000 tons of shells which are worth more than $1,000,000. We are all wearing pearl buttons from this source, which will be missed if the great river becomes too foul for the growth of Mussels.

Young Mussels attach chiefly to the gills of fishes, and in some species to the fins, during the early period of their lives. It is now practically certain that all Mussel spawn which fails to find a suitable fish host sinks to the bottom and dies.

The young Mussels are temporarily provided with minute hooks for attachment and are soon enveloped in the epithelium of the fish, where they remain encysted until the shell begins to form and they can safely drop off.

All fishes are not equally susceptible to these temporary mollusk parasites; some receive very few, others shed them too soon, while still others die as a result of carrying too many. Practical work is in progress, and large numbers of fishes "infected," as it is called, with young Mussels are liberated to stock the public waters, as their "parasites" develop and fall off.

The "planting" of the Mussels is, therefore, left to the fishes. It is even possible to send Mussel-bearing fishes to waters outside the Mississippi system and thus introduce the more valuable Mussels elsewhere.

TURTLES, FROGS, AND CRAYFISH

There are several species of large Turtles of the kinds known as "sliders" in our fresh-water streams and lakes, especially in the Middle and Southern States, that contribute to the food supply. They have long been used in filling the ever-widening vacancy in the markets formerly occupied by that favorite of the epicure, the Diamond-backed Terrapin of the salt-water marshes.

They have so high an edible value that it is whispered we often pay Terrapin prices for Turtles that never saw brackish water. Fishery officials are aware of their importance and have studied their distribution, methods of capture, and conservation.

Frogs of several kinds are valued aquatic food delicacies, and their habits have received considerable attention with the view to developing a practical system of frog-culture. It is to be hoped that some method of conservation will be

Photograph by Fred H. Kiser

AMONG THE CHALETS OF THE CUTBANK VALLEY, GLACIER NATIONAL PARK: MONTANA

The United States Government established a fish hatchery in Glacier National Park recently and has planted nearly 4,000,000 fish there in the last two years. The waters of the park abound in Rainbow, Brook, and Mackinaw Trout, Grayling, and Whitefish.

Photograph by Putnam Studios

TROLLING FOR TROUT IN LAKE TAHOE

The Lake Tahoe Trout (*Salmo henshawi*) inhabits several lakes of the high Sierra. It attains a weight of six pounds. There is also a Deep-water Trout in this lake (*Salmo tahoensis*), which is never found in shallow water.

Photograph by William H. Zerbe

ON HIS WAY TO THE HUNTING GROUND OF YOUTH

Photograph by Maynard Owen Williams

FISHING IN THE POTOMAC FROM THE NATIONAL CAPITAL'S WATERFRONT

found before the natural supply approaches the point of exhaustion.

The annual market supply of fresh-water Turtles and Frogs has been known to exceed half a million pounds of each, the great bulk of the catch being derived from the Mississippi and its tributaries.

The humble Crayfish, although of small size, figures prominently in the aquatic food supply, Lake Michigan leading with over 200,000 pounds annually.

FOODS OF FISHES

A subject of perpetual interest to all who fish with the rod is the food of fishes. There are moments in the lives of all of us when the most important thing in the world seems to be how to get the fish to bite. The problem is taken as seriously by the captain of some great industry, off on a fishing trip, supplied with the most expensive tackle, as by the barefooted urchin with a homemade pole, and doubtless the man of business is the more serious of the two.

Thanks to the patient laboratory investigations of Professor S. A. Forbes, this dark question has been made luminous. He tells us that while the food of fishes consists chiefly of other fishes, it includes practically the whole aquatic fauna—a comforting fact when we would seek for baits.

Fishes not only feed on other fishes and on insects, but on crustaceans, mollusks, and worms. Plants do not constitute much of their food, although a few kinds feed on them, such as Buffalo-fishes, Carps, and Minnows. Some fishes get food by rooting in mud, while others are inclined to be scavengers.

Among the chiefly fish-eating fishes may be mentioned Pike, Pickerel, Muskellunge, Pike-perch, Burbot, Gar, Black Bass, and Channel Catfishes. Those taking fish food in moderate amounts are represented by Bream, Blue-cheeked Sunfish, Mud-fish, White Bass, Rock Bass, and Crappie.

Fishes which feed on other fishes to a trivial extent are White Perch, Suckers, Spoonbill, the various Darters, Top Minnows and Silversides, Sticklebacks, Mud Minnows, Stone-cats, and common Minnows. The whole Minnow tribe contributes to the food of the smaller fish-eaters.

In the Mississippi region the Gizzard-shad constitutes 40 per cent of the food of the Wall-eyed Pike, 30 per cent that of

Photograph from U. S. Forest Service

LAKE TROUT CAUGHT IN SUPERIOR NATIONAL FOREST: MINNESOTA

The Great Lakes Trout, or Mackinaw Trout (*Cristivomer namaycush*), inhabits many of the larger northern bodies of water outside the Great Lakes. It is a good game fish, wherever found.

the Black Bass, half that of the Pike, and a third that of the Gars. This is a good illustration of the usefulness of an abundant species of little importance as food for man.

Mollusks—the Snails and Mussels of various species—are also important as fish food. They form large proportions of the food of Catfishes, Suckers, Freshwater Drum, and Mudfish. About 16 per cent of the food of Perches, Sunfishes, Top Minnows, and Shiners is molluscan in character.

Fishes feed freely on insects, not only on the aquatic forms in their various larval and mature stages, but also on terrestrial insects cast into the water in many ways.

Crustaceans appear to be of even more importance as fish food, especially the minute Entomostraca. The Crayfishes are also eaten.

The food of adult fishes naturally differs greatly from that of the young. In addition to natural foods, both alive and dead, fishes in captivity will devour many kinds of meats and prepared foods. The question, then, as to what constitutes the food of fishes may be answered: almost any living animal forms from the water not too large to be swallowed. Therefore if the fish will not take the bait or the fly first offered, it may be tempted with another, and the resourceful angler need not return with an empty creel.

AGE, GROWTH, AND HABITS OF FISHES

Little can be learned definitely about the ages attained by fishes, unless individuals are kept under observation in captivity, either in public aquariums or in the ponds of fish-culturists.

The tagging experiments made on young fishes at Government Salmon hatcheries on the Pacific coast have yielded information as to the ages when these fishes, after attaining maturity in the sea, return to spawn in their native rivers.

As all of the five species of Pacific Salmons perish after their first and only spawning, tagging reveals only the age at breeding maturity, which seems to vary

© Haynes, St. Paul

CATCHING YOUR FISH AND COOKING IT WITHOUT MOVING FROM YOUR TRACKS

The Yellowstone Trout (*Salmo lewisi*) is very abundant in Yellowstone Lake, Yellowstone National Park. The "boiling pot" is one of the numerous hot-water holes to be found in this region. The surrounding water is cold.

between the fourth and the seventh year, according to the species.

The records of public and private aquariums, however, furnish data that we may consider reliable. The European Eel has undoubtedly lived for long periods in captivity. According to accepted authorities, a few specimens kept in aquariums have lived for periods varying from 20 to 55 years. Boulenger, in the Cambridge Natural History, states that an Eel kept by the French naturalist Desmarest for "upwards of 40 years" reached a length of four and a half feet.

It is recorded that four Russian Sterlets had lived in the private aquarium of Captain Vipan in Northamptonshire for 25 years. He also had a Golden Orfe still living after 24 years of captivity. A record from the Brighton Aquarium is that of a Sterlet which died after having been kept there "about 38 years."

The Australian Lung-fish is known to have lived at the London Zoölogical Gardens more than 19 years.

There are accounts of European Trout said to have been kept in captivity for 53 years, and of Carp still longer, but such are hardly comparable in verity with the records of existing public and private aquariums.

The New York Aquarium still has specimens (1923) of the Mudfish or Bowfin and the Long-nosed Gar which were received in 1903. There are also living Short-nosed Gars brought from the Mississippi River in 1904.

In the Aquarium certain North American fishes have lived for long periods, viz., Striped Bass, 20 years; Whitefish hatched in the building in 1913 are still living; Large-mouthed Black Bass, 11 years; Muskellunge, Calico Bass, Rock Bass, and Yellow Perch, 10 years. The last four were adults when received and are still living.

A Striped Bass kept in captivity for 19 years weighed 20 pounds and was three feet long when it died. Its length when received was about six inches. This species sometimes attains a weight of 80 pounds or more. It is likely that some

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THE "FISHING ROD" OF THE OJIBWAY INDIANS OF NORTHERN MINNESOTA

Most of the northern tribes of Indians are adepts with the fish spear.

species grow faster in freedom, where they find their natural foods, but other kinds may develop faster in suitable ponds, where they are well cared for and protected from enemies.

Wild fishes of exceptionally large size being often found, we may assume that fishes continue to grow through life, the period of life depending largely upon enemies. In a world beset with sharp fangs and claws, the life of a wild animal, either in the water or on land, is apt to end in a tragedy.

TELLING THE AGE OF A FISH BY ITS SCALES

It is now known that the scales of fishes bear marks which indicate the length of life and the rate of growth in different years. Studies of the Atlantic Salmon in Scotland and of the various species of Pacific Salmon have proved this.

The scale grows in proportion with the rest of the fish, principally by additions around its border. The fish grows at different rates during different seasons of the year. Concentric ridges form around the edge of the scale, its marginal expansion in summer being more rapid than in winter, so that the growth during each year is usually distinguishable. (See illustration, page 153).

Studies of the five species of Pacific Salmons have shown the ages at which the different species return to the rivers to spawn. Thus, the ridges on a fish's scales are comparable to the annual ring growths revealed on a cross-section of a tree trunk, which tell its age.

It is interesting to note that the "tagging" of young Pacific Salmons, previously referred to, has already served to indicate that, after attaining maturity in the sea, each returns to spawn in the identical stream in which its life began.

Studies of the scales of Whitefishes in the Great Lakes have shown that the scale characters are so well defined that they indicate the age of the individual fish and the rate of growth of the species.

Scales from Whitefishes hatched and reared in the New York Aquarium and therefore of known age (see illustration, page 131) have been used by Government biologists in checking the results of studies of the scales of wild fishes.

The sexes of fishes are not as readily

Photograph by T. J. Golden

A LAKE CHAUTAUQUA MUSKELLUNGE

This specimen, which was 52½ inches long, with a girth of 24½ inches, weighed 42 pounds (see text, page 157).

Photograph by E. R. Sanborn

YOUNG SMALL-MOUTHED BLACK BASS WINTERING IN AN AQUARIUM

The fish remain poised in mid-tank, crowded closely together. As long as plants can be kept growing in the cold water the fish will pack themselves tightly among them. While the temperature of the water remains low, the fish seldom take food.

distinguishable as in the case of birds. Males and females are usually so much alike that only the expert recognizes the differences, and in many species the dissecting knife must be employed to determine the fact.

The colors of fishes vary somewhat according to the waters which they inhabit, and this applies also to fishes held in captivity, where their colors tend to become more subdued. The fishes of exhibition tanks, however, brighten their colors during the spawning seasons, much as do wild fishes.

The habits of fishes have not been studied as thoroughly as have those of birds, mammals, and other vertebrated animals. Books on fishes are largely of two classes: those written by anglers, relating chiefly to methods employed in the capture of the fish, and those written by the systematic naturalist, dealing chiefly with classification and distribution.

In neither class of books is the life of

Photograph by E. R. Sanborn

THE AMATEUR FISHERMAN'S DELIGHT: ROCK BASS

Whatever it may lack in reputation among scientific fishers, this species is one of the most popular among average anglers. From the St. Lawrence to Texas, the legion of the unskilled easily transfer it from its rocky haunts to the frying-pan.

the fish in its own environment very fully considered. There are, of course, satisfactory life histories of certain common species, especially those inhabiting the smaller streams, and fish-culturists are contributing new information on the ways of fishes reared in ponds.

Since the keeping of fishes in aquariums became common, many important facts have been recorded, but observations on creatures in captivity can manifestly deal with but little of their real life.

For many important facts relating to the senses of fishes we are indebted to the modern biological laboratory. Facts based on scientific experiment relative to fishes' powers of hearing and memory, their color changes, sleep, electrical and poisonous properties, the sounds they make, and so on, are slowly being brought to light.

The naturalist who can devote himself to the observation of the ways of fishes will find a fascinating field and contribute new facts to science.

SPOTTED CATFISH (Ictalurus punctatus), COMMON BULLHEAD (Ameiurus nebulosus) and other Catfishes

(For illustration see Color Plate I)

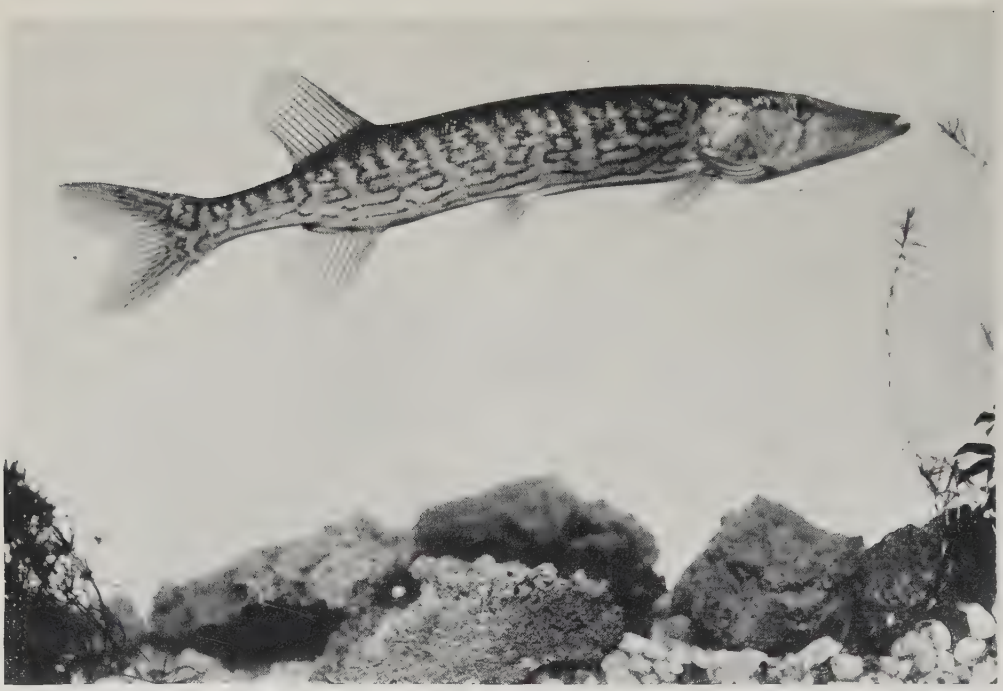
There are many kinds of Catfishes in the United States, all of which belong naturally to that part of the country lying to the east of the Rocky Mountains, those now abundant in some States west of the Rockies having been introduced.

Catfishes are of considerable importance commercially. The fishery statistics of a few years ago show that the annual catch for market exceeded 14,000,000 pounds, but to-day the supply is much smaller.

Being easy to catch, the total of those taken everywhere with hook and line can only be conjectured, but it may possibly equal the quantity yielded by the net fisheries.

As Catfishes in general have the habit of guarding their nests and protecting the young, the supply holds out well in spite of exhaustive fishing. Such habits also as feeding chiefly at night and feeding but little in winter contribute to their preservation

The Blue Catfish, inhabiting the Mississippi Valley, is the largest and best of all as a food-



Photograph by E. R. Sanborn

THE EASTERN PICKEREL IS WIDELY DISTRIBUTED

This species inhabits every State east of the Alleghenies, where there are lakes, ponds, and slow streams. Bass and Trout fishers do not praise it, but thousands of others take it thankfully.

fish. It occasionally attains a weight of 125 pounds and 80-pound specimens are not uncommon, but like other fishes taken in large numbers, the average weight is only a few pounds.

The Blue Catfish is less inclined to live in muddy waters than some other species, preferring the clearer and swifter streams. It is a clean feeder, living much on fishes and Crayfish. As a game fish it is one of the best in the Catfish family, taking many kinds of baits, and is a strong fighter on the line, but never adds to the angler's thrill by leaping from the water.

The Blue Catfish is decidedly given to migratory movements according to seasonal changes in temperature, gathering in the more southerly parts of its range in winter.

The Spotted Catfish (*Ictalurus punctatus*) belongs in the Mississippi Valley and the Great Lakes. It does not reach the size of the Blue Cat, seldom weighing as much as 25 pounds. Like the Blue Catfish, it is a trim and active fish. There are four species in this genus, all having forked tails.

One of the best-known Catfishes is the Common Bullhead (*Ameiurus nebulosus*) inhabiting streams, lakes and ponds of the Eastern and Middle States and distributed as far westward as the Dakotas and Texas. Another fish of this round-tailed genus is the Black Bullhead (*Ameiurus melas*), having much the same distribution. The Bullheads are easily raised in ponds, and under proper management yield a good supply of white and palatable fish food. All of our native Catfishes have tough, scaleless skins and small eyes, and all have eight barbels or feelers on upper and under sides of the mouth, which are useful in searching for food in the muddy waters that many of them inhabit.

Catfishes make their nests usually in sheltered spots, such as can be found under rocks, submerged logs, and stumps, and do considerable excavating in enlarging them. They are springtime spawners. The eggs hatch in a few days and the young stay with the parent fish until about an inch long.

Catfishes in general are omnivorous, feeding on animal life, and are not averse to downright scavenging. They are very hardy and few fishes can live longer out of water. As they have dangerous spines on dorsal and pectoral fins, fishermen soon learn to handle them circumspectly.

As kept in tanks, Catfishes become nearly dormant when the water turns cold. A 60-pound Mississippi Catfish (*Leptops olivaris*), which lived in captivity several years, took no food during the winter months and remained practically motionless.

The name Channel Catfish is a term rather loosely applied by fishermen to several of the larger fishes of large streams.

Fully a dozen of our numerous kinds of Catfishes are important as food.

Photograph by E. R. Sanborn

TEN-YEAR-OLD WHITEFISHES

These specimens were hatched in the New York Aquarium. Being the only Whitefishes of known age available, scales from them are used by biologists in checking the results of studies of the ages of wild Whitefishes (see text, page 127).

THE BLACK BASSES (Micropterus dolomieu and Micropterus salmoides)

(For illustration see Color Plate II)

The two closely related Black Basses are easily distinguished by the size of the mouth and by the color pattern. In the Small-mouthed species the upper jaw does not extend beyond the eye, as in the case of the Large-mouthed Bass; in the former there is much dark blotching, which tends to form short vertical crossbands, while the latter has usually a dark band along the side.

The expert angler thinks he can distinguish the species he has hooked before seeing it, as the Small-mouthed Black Bass is by far the gamier and more active. Its reputation as a game fish is not surpassed by any other of its size.

Although the Black Basses are cultivated and distributed both officially and by private effort, they are not fishes whose mature eggs can be stripped by hand and developed in hatchery buildings by wholesale methods. Their propagation is effected by the more natural but slower method of pond culture, in which the fishes are provided with the conditions most favorable to their mating and the rearing of their young.

The same limitations in culture apply to all fishes of the Bass-Sunfish family, which have the habit of making nests and protecting their young.

The Small-mouthed Bass is the fish that pond-owners find most satisfactory and they are justified in the selection. Much of its present wide distribution is due to this fact.

This truly American fish has been much written about and naturally has many names in its extensive range, but Small-mouthed Black Bass is the most widely used as well as the most distinctive. It is found from Lake Champlain, through the Great Lakes to Manitoba, along the Atlantic slope to South Carolina, throughout the upper Mississippi Valley, and in the lakes of southern Canada.

The size of the Small-mouthed Bass depends largely on the waters it inhabits. Fishes of four or five pounds are decidedly large. There are records of specimens still larger, but the angler of to-day in our overfished streams and lakes is well content with a two-pounder.

The Black Basses defend their eggs on the spawning nests with great vigor and it is the male that assumes this task, the female deserting as soon as the eggs have been deposited. His care is continued for a few days after the young appear, when they begin to scatter.

The Large-mouthed Black Bass has a wider distribution than the Small-mouthed species, especially southward, extending into Florida and other States along the Gulf coast. It is in general more abundant and inhabits more sluggish waters.

In the North the two species are commonly

found together. The Large-mouthed species is decidedly larger and in Southern waters sometimes exceeds 12 pounds in weight, but average weights are two or three pounds.

This fish has even more names than its relative, but Large-mouthed Bass serves to identify it wherever the two are found together. As a popular game fish, we are safe in placing it next to the Small-mouthed Bass.

The Black Basses are carnivorous fishes, the young feeding largely on insect life, the adults on fishes, Crayfish, and Frogs. In bait fishing these foods, together with the larger insects and their larvæ, are all used. Expert anglers take both species successfully with trolling spoon and artificial fly.

ROCK BASS (Ambloplites rupestris)

(For illustration see Color Plate III)

Among the native fresh-water fishes living in the Aquarium there are few that adapt themselves more readily to the conditions of captivity than the Rock Bass. In a tank now containing fifteen specimens, mostly of large size, there have been no losses for several years.

The natural range of this fish includes the Mississippi Valley, the Great Lakes, and Lake Champlain drainages, but it has been introduced through fish-cultural operations into many States east of the Alleghenies. Its adaptability to pond cultivation will ultimately extend its distribution.

The methods of the expert angler are not at all necessary for the capture of the Rock Bass. Great numbers are taken by amateur fishers wherever it abounds and during the greater part of the year.

In its feeding habits the Rock Bass is about as omnivorous as any member of the Bass-Sunfish family, to which it belongs. Crayfishes and other fresh-water crustaceans, aquatic insects and their larvæ, Snails, and such fishes as its rather large mouth will admit, all contribute to its natural food supply. If we include the grasshoppers, crickets, grubs, earthworms, and other terrestrial baits used in catching it, the food list might be considerably extended. Fish-culturists have found that this species not infrequently cannibalizes to some extent on its own young.

In addition to the baits already mentioned, the trolling spoon and other artificial lures are used successfully; but the Rock Bass has few of the fighting qualities of the Black Basses, for it soon yields to the pull of the line.

The Rock Bass is a thick-bodied, meaty fish, and a couple of fair-sized ones will fill the pan. There are specimens in the Aquarium a foot long that have nearly trebled in size since their arrival, six years ago. It is known, however, to grow somewhat larger.

At spawning time, late in May, the Rock Bass makes its nest in shallow water along shore, like Basses and Sunfishes generally. The fishes are sociable at this time and their nests are often found in groups close together, which is not the habit with the pugnacious male Black Basses.

CALICO BASS (Pomoxis sparoides) and CRAPPIE (Pomoxis annularis)

(For illustration see Color Plate IV)

The Calico Bass belongs naturally to the region including the Great Lakes and the Mississippi Valley. Being a good food-fish and well adapted to cultivation in ponds, its distribution has been considerably extended by artificial means.

Like other widely distributed fishes, it has several names, one of which, Black Crappie, is sometimes used to distinguish it from its nearest relative, the Crappie or White Crappie. Both kinds are found in the above-named region, but, being of similar appearance, anglers do not always recognize the differences.

The Calico Bass has a relatively deeper body, is darker than the Crappie, and weighs more as compared with a Crappie of the same length. Naturalists easily distinguish them by their dorsal spines, the Calico Bass having seven or eight, while the Crappie has five or six.

The name Calico Bass is suggested by its markings, the Crappie being always paler. Both kinds are found in Western markets. The annual market catch in the Mississippi Valley, of the two combined, sometimes exceeds 1,000,000 pounds. The Calico Bass is chiefly a feeder on aquatic insects and their larvæ. It lives peaceably with other fishes when kept in ponds. So many are taken by anglers that it has been called "the fish for the millions."

If the Calico Basses which have lived in the Aquarium for 10 years continue to thrive in captivity, it will be interesting to see what size they attain with increasing age. Exceptionally large specimens have been reported as exceeding two pounds in weight.

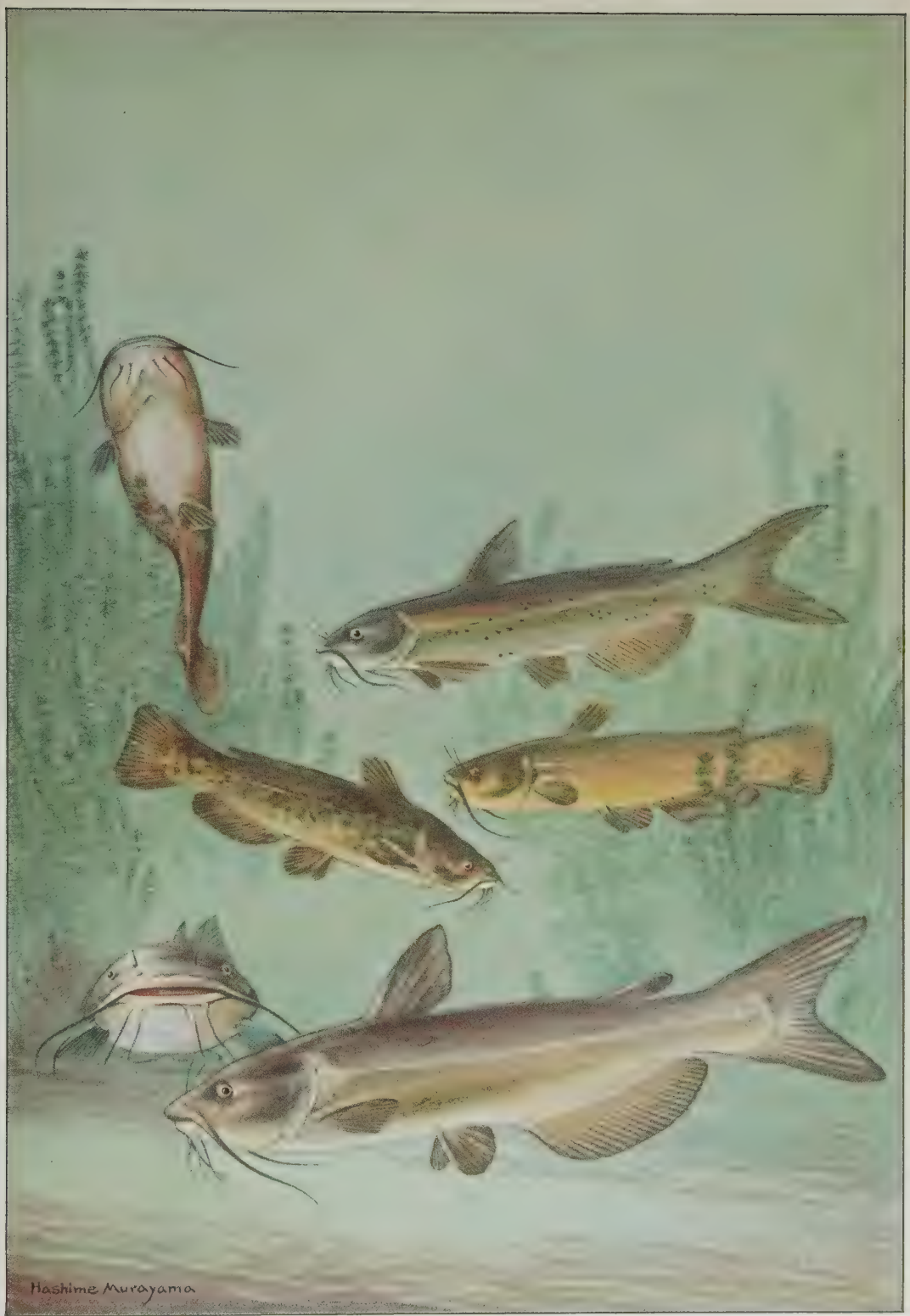
WHITE PERCH (Morone americana)

(For illustration see Color Plate V)

There are few native fishes that live equally well in fresh or salt waters. The White Perch, living chiefly in brackish tidal waters, ranges freely into both. In rivers it passes up beyond all trace of salinity and often becomes landlocked in strictly fresh ponds, where it breeds for considerable periods. On the other hand, it is taken in abundance about coastal islands where conditions are altogether those of the salt sea.

In aquariums it has been kept for long periods in tanks, either fresh or salt, but the best results have been obtained in tanks supplied with both kinds of water. There are specimens now living in such artificially maintained brackish water that are 10 years old. They have reached lengths of 10 to 12 inches and continue to be hardy under the restrictions and the monotonous fare of life in captivity.

Years ago specimens of live White Perch intended for exhibition were obtained from one of the park lakes in New York City where they had been introduced; but, although fully protected, the supply gradually diminished to the vanishing point. It would seem, therefore, that the race cannot breed indefinitely in fresh



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Painted by Hashime Murayama

SPOTTED CATFISH (*Ictalurus punctatus*) [at top]; COMMON BULLHEAD (*Ameiurus nebulosus*) [in middle at left], AND OTHER CATFISHES

There are many kinds of Catfishes in our waters, and they are abundant enough to be of considerable importance in the supply of food fishes. The annual catch for market has been known to exceed fourteen million pounds. Great numbers are also taken everywhere with hook and line.

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Painted by Hashime Murayama

LARGE-MOUTHED BLACK BASS (*Micropterus salmoides*) [upper]; SMALL-MOUTHED BLACK BASS (*Micropterus dolomieu*) [lower]

The Black Basses are both well-known anglers' fishes, the Small-mouthed species being by far the gamier of the two. Although closely related, they are easily distinguished by the size of the mouth and by the color pattern; in the Small-mouthed Bass the upper jaw does not extend beyond the eye as in the Large-mouthed species. In the former the color markings tend to form vertical bands, while the latter has a dark stripe along the side.

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Painted by Hashime Murayama

ROCK BASS (*Ambloplites rupestris*)

This fish is well known in the Mississippi Valley and the States bordering on the Great Lakes. It is valued for both food and sport. Great numbers are taken by amateur fishermen wherever it abounds, and it can be caught during the greater part of the year. A couple of fair-sized Rock Bass will fill the frying pan. A name often applied to this fish is "Red-eye."

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Painted by Hashime Murayama

CRAPPIE (*Pomoxis annularis*) [upper]; CALICO BASS (*Pomoxis sparoides*) [lower]

These fishes belong chiefly to the Great Lakes region and the Mississippi Valley. They are much alike in appearance, but the Calico Bass has seven or eight dorsal spines, while the Crappie has five or six. Both are fine sport fishes and both are handicapped with many local names.

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WHITE PERCH (*Morone americana*)

The White Perch belongs to the Atlantic coast region, and is one of the few fishes that live in both fresh and salt waters. It not only ranges far up the rivers, but is taken in abundance by net fishermen along the coast. The White Perch is good eating whether from fresh or salt water and anglers take it with all sorts of baits. It sometimes reaches a weight of two pounds.

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BROOK TROUT (*Salvelinus fontinalis*)

This is doubtless America's favorite game fish and the one most written about. It is not only much sought by anglers, but is raised by fish-culturists for the fancy price it brings in the market. Over-fishing, deforestation and water pollution all contribute toward the steady reduction of its numbers and the restriction of its range.

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LAKE TROUT (*Cristivomer namaycush*)

This is the largest of all Trouts, having been known to reach a weight of one hundred pounds. It ranks next to the Whitefish in commercial importance; the total annual catch in the Great Lakes recently exceeded thirteen million pounds. Anglers take many in the lakes of Maine, where it is called "Togue."

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McCLOUD RIVER RAINBOW TROUT (*Salmo irideus shasta*)

The Rainbow has been introduced into most of the Eastern States. It is larger than the Brook Trout and can live in warmer water. Although anglers do not consider it quite so gamy, it is a valuable sport and food fish, especially useful in stocking waters no longer suitable for Brook Trout.

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PIKE (*Esox lucius*) [upper]; EASTERN PICKEREL (*Esox reticulatus*) [lower]

The Pike of North America is probably not distinct from the Pike of the Old World. Specimens have been taken weighing over forty pounds. The Eastern Pickerel is the largest of our three species. Both Pike and Pickerel are valued as food and game fishes and like the Muskellunge are exceedingly voracious.

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LAKE STURGEON (*Acipenser rubicundus*)

The history of the Sturgeon is a story of wanton waste. When the fisheries of the Great Lakes were first being exploited, the Sturgeon was destroyed as useless. Now that its great value is recognized, it may be too late to save it from extinction, as fish-culturists have not been able to solve the problems connected with its propagation. The Sturgeon is valued chiefly for the caviar made from its eggs.

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LAKE CHAUTAUQUA MUSKELLUNGE (*Esox ohiensis*)

Painted by Hashime Murayama

There are three species of Muskellunge, the one shown here inhabiting Lake Chautauqua and the upper Ohio River system. All are Northern fishes, much alike in habits. The Muskellunge is the largest of the Pike family and in the Great Lakes has been known to exceed eighty pounds in weight. It is celebrated as a game fish having both size and strength. In bringing to gaff a large Muskellunge, the angler must put all his dexterity into full play.

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COMMON WHITEFISH (*Coregonus clupeiformis*)

This is one of the most abundant and valuable of our food fishes, and with other Whitefishes one of the most important fresh-water fishes in the world. Over twelve million pounds of Whitefish have been taken in the Great Lakes in a single year. The Whitefish is the subject of extensive propagation by the Government.

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Painted by Hashime Murayama

FRESH-WATER DRUM (*Aplodinotus grunniens*)

This large fish of the Great Lakes and the Mississippi Valley is of considerable importance in the market fisheries, but of little interest to anglers except in the South. It is related to the Sea Drum and makes the same drumming sounds. It has heavy grinding teeth like the sea variety and feeds chiefly on Mollusks and Crayfish. Anglers take it best with Crayfish bait.

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Painted by Hashime Murayama

YELLOW PERCH (*Perca flavescens*)

Found throughout the Northern and Eastern States, this is one of our best-known fishes. It is caught by anglers of all ages, and great quantities are taken for market with nets. Among the commoner fishes there is none of better flavor. It comes as near being everybody's fish as any other.

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Painted by Hashime Murayama

SAUGER (*Stizostedion canadense*) [upper]; PIKE-PERCH (*Stizostedion vitreum*) [lower]

The Pike-perch, often called "Wall-eyed Pike," belongs to the Perch family, although its form is suggestive of the Pikes. It has been known to reach a length of three feet. In commercial importance, it ranks next to the Whitefish and the Lake Trout, millions of pounds being taken in the net fisheries of the Great Lakes. Anglers find the Pike-perch a good game fish. The young are liberated from Government hatcheries by hundreds of millions. The Sauger has the same northerly distribution as the Pike-perch. It resembles it in appearance, but is smaller and of less commercial importance.

© Painted by Hashime Murayama

COMMON EEL (*Anguilla rostrata*)

The Eel is a fish that spends its long life in fresh water, descending to the sea in old age to spawn but once and die. For centuries its mysterious ways have puzzled naturalists who have discovered recently that it spawns near the Bermuda Islands in deep water, the transparent larval Eels not seeking the rivers until a year old, when they appear as Elvers working upstream.

waters, but must renew its fertility through occasional baths in the vitalizing sea.

Complete exclusion from the brackish or fresh waters, where it spawns, would doubtless lead to extermination as readily as long-continued imprisonment in absolutely fresh water. According to the records of anglers, the largest specimens are those taken in salt or brackish waters.

The White Perch belongs to the tidal region of the Atlantic coast from Nova Scotia to South Carolina. It is abundant around Long Island and in the Hudson River up as far as Albany. It is taken through the ice in the Hudson, where it is present throughout the year.

It is equally abundant in the Delaware and Susquehanna rivers and Chesapeake Bay, ranging well upstream, and is commonly taken in pound and fyke nets along the coast.

In North Carolina the annual catch amounts to 1,000,000 pounds. Anglers catch it in abundance and net fishermen keep the markets well supplied with it. Fishery statistics show that the market catch along the Middle Atlantic States sometimes amounts to 2,000,000 pounds a year.

The White Perch is good eating, either from fresh or salt water. Hook-and-line fishers find Shrimp bait the best, but it responds readily to Minnows, young Eels, small Crabs, or any of its natural foods. Specimens of two or three pounds are reported from the eastern end of Long Island. In fresh waters, worms, grasshoppers, and other insects are effectively used.

The White Perch rises to the fly, especially in fresh waters, and resists bravely when hooked. A fish a foot long weighs about two pounds, but this is larger than the average.

It is a gregarious species, usually frequenting the shallower waters along shore. Spawning begins soon after the ice leaves and lasts a couple of months. Females have been taken with eggs as late as June 10. Fish-cultural experiments have shown that the eggs can be hatched artificially in from three to five days.

Considering the adaptability of the White Perch to the conditions of captivity, especially in brackish water, there is reason to suppose that it will receive more attention from fish-culturists than it has in the past. Anglers would know it better if its range extended farther inland.

BROOK TROUT (Salvelinus fontinalis)

(For illustration see Color Plate VI)

The Brook Trout is the favorite game fish of America. Originally found from Labrador westward to the Saskatchewan and southward along the Alleghenies to Georgia, it has been carried by fish-culturists to the Rockies, the Sierras, the upper Mississippi Valley, and wherever rapid streams of suitable temperature are found.

It has almost disappeared from lowland streams in the North, which have become unsuited to it as a result of deforestation and water pollution.

The Brook Trout persists in small coastal streams where the conditions favorable to it have not been disturbed, and it often descends to brackish water. It will live in streams having a summer temperature as high as 70°, provided they have swift currents.

The Brook Trout cannot live through the summer in the New York Aquarium without the aid of refrigerated water, although the city supply is derived in part from the Catskill Mountains and flows 100 miles underground. The Brook Trout will live in cool lakes and ponds, but cannot reproduce in such situations without access to the gravelly beds of running brooks at spawning time.

Trout culture in America dates back to the early fifties. Fish-culturists raise great numbers of Brook Trout, both for market and for distribution in small artificial ponds, by feeding the fishes and caring for the eggs in hatchery troughs provided with flowing spring water.

The instinct to move upstream is very strong in young Trout; when a miniature "fishway" with its stairs of tiny box pools is connected with a hatching trough, they will promptly begin to ascend and cannot, in fact, be kept down while water is allowed to flow through it.

The Brook Trout spawns in the fall, when streams begin to cool, but the eggs do not hatch out until springtime brings higher temperature. The hatching period lasts from three to six months, according to latitude and altitude. The Brook Trout spawns when two years old. Larger and older fishes deposit from 500 to 2,000 eggs.

In lakes where there is an abundant food supply, the Brook Trout has in the past been known to reach the rare weight of 10 pounds; but to-day, when thousands of anglers are whipping the Trout streams, a one-pound Trout is a large one. Many good Trout waters have been ruined by the ill-advised introduction of predatory fishes.

The coloration of the Brook Trout is extremely variable. In some waters the fish may exhibit all the brilliancy of which it is capable, while in another watershed not far away it is so dark that but little color is discernible.

A notable illustration of this is found on Long Island, the Trout on the south side of the island being among the showiest of the species, while those of the north side are as dark as the Brook Trout ever becomes, although the supply on both sides is maintained by hatchery-raised fishes. After a few months in captivity, the bright colors of the former tend to disappear, while the latter become somewhat paler. This may be due largely to a change in diet and the exclusion of direct sunlight from the tanks.

In the Trout, as in many other fishes, the colors vary with age.

In streams the Brook Trout is largely a feeder on aquatic insects, while in lakes and ponds it feeds much on small fishes. In the Aquarium it subsists cheerfully on chopped fish, like the other captives of the tanks, and in the average hatchery pond becomes a fat liver-fed gourmand.

The Brook Trout is not a leaping fish, like the Bass, when hooked, although it may rise clear of the surface in striking the fly.

We need not describe methods of capturing the Trout; anglers have been writing of this in great detail since the days of the Father of Anglers. No native game fish is more worthy

Photograph by E. R. Sanborn

A STRONG FIGHTER ON THE LINE: MCCLOUD RIVER RAINBOW TROUT

This McCloud River variety is the stock from which our introduced California Rainbow Trouts were derived. It is more given to leaping than the Brook Trout.

of protection in the waters still suited to it than the Brook Trout.

LAKE TROUT (Cristivomer namaycush)

(For illustration see Color Plate VII)

The Lake Trout of the Great Lakes belongs chiefly to the fish trade. In these inland seas the angler's share is small in comparison. It is the largest of all Trouts and is known to have reached a weight of 100 pounds. The average of those taken in the gill nets used at the present time weighs less than 10 pounds, while those caught by anglers along shore average but half that weight. The writer once accompanied a northern Alaska expedition, a member of which brought into camp specimens of this Trout exceeding three and a half feet in length. They were taken in a large lake at the headwaters of the Kowak River, above the Arctic Circle, where they were very abundant.

Among our fresh-water fishes the Lake Trout ranks next to the Whitefish in commercial importance. It is found throughout the Great Lakes and from there northward, in all the large lakes of British America and Alaska.

A deep-water form of this Trout, called Siscowet, is taken in great numbers in Lake Superior, the gill nets being set at times in depths exceeding 500 feet and lifted by steam power. The writer once made a cruise north of the Apostle Islands on a steam fishing boat operating 40 nets, each 600 feet long. These were set in one "gang," constituting a single net more than four miles in length.

Each deep-water fishing boat attends to four or five of these great nets. As the net is lifted by the windlass forward, it is carried aft in sections, put together again, and paid out over the stern. The nets were about eight feet wide, with four and a half inch mesh.

The largest of the deep-water Lake Trout taken by our vessel was two feet ten inches long and weighed 21 pounds.

It would be interesting to know the greatest depth at which Lake Trout have been taken, as Lake Superior, one of the deepest lakes in the world, has depths exceeding 1,000 feet and its bottom is far below sea-level.

Some time later a day was spent on a steam fishing boat in the Georgian Bay near its connection with Lake Huron, and the lifting of a gill net six miles in length was observed. It was set at a depth of 100 feet and the work of lifting and resetting occupied five hours. The catch was nearly 1,000 pounds of Lake Trout, the largest of which was three feet long and weighed 15 pounds.

There are many steam vessels in the Great Lakes engaged in such wholesale fishing, as long as the Lakes are free from ice. The annual net catch of Lake Trout in the Great Lakes in 1917 exceeded 13,000,000 pounds.

The writer has taken Lake Trout in the Georgian Bay at depths of about 50 feet with hand line and trolling spoon, but the sport would have been better had rod and reel been used. Anglers who have used the rod with 300 feet of line and Minnow bait find that the fish can be played in a satisfactory manner.

Surface trolling, when the Trout are found in shallower waters, affords better sport. In smaller and shallower lakes, like those of Maine, where summer water temperatures are higher than in the Great Lakes, the Lake Trout is often taken with the fly. In Seneca Lake, in New York State, it is taken with a special trolling rig designed to play the spoon 10 or 20 feet under the surface.

The Lake Trout is easily distinguished from other Trouts by the numerous small, pale-yellowish spots which cover its body from head to tail. It is a voracious fish. Forbes tells of a 20-pound Lake Trout which had 13 good-sized Lake Herring in its stomach.

Lake Trout fry are turned out by the fish hatcheries in great numbers. The spawning season varies in different lakes. Five or six thousand eggs are stripped from fishes of ordinary size, but large specimens yield many more. The eggs hatch in from two to three months.

The Lake Trout endures captivity very well; the Aquarium has 20-inch specimens received in 1919, some of them perfect albinos with bright pink eyes.

Several names are applied to the Lake Trout, one of which is Mackinaw Trout. In the lakes of Maine it is called Togue, while in Canadian lakes it goes by the Indian name Namaycush.

McCLOUD RIVER RAINBOW TROUT (Salmo irideus shasta)

(For illustration see Color Plate VIII)

The Rainbow Trout belongs to the Pacific slope of the Sierras and Cascades; wherever it is found to the eastward of these ranges it is an importation.

There are several geographic races of this Trout, the one now found in Eastern streams and lakes being the northern California variety, *Salmo irideus shasta*. Commencing in the early eighties, the original stock was widely distributed from the Government hatchery on McCloud River south of Mount Shasta. It was the writer's good fortune to be attached to this station years ago and to participate in its work.

The acclimatization of this fish in other parts of the United States and in foreign countries is one of the notable successes of modern fish culture. Taken to New Zealand in the late eighties, it soon became well established there.

The introduction of the Rainbow Trout in Eastern States provided a substitute for the Brook Trout in many waters which had become unsuitable for that species, as a result of advancing civilization.

While generally not as large in the East as in its native Sierra streams, it has in certain favorable localities been found even larger. It can endure warmer water than the Brook Trout and live farther downstream than that species. In streams near the sea it often lingers in brackish water.

While the Rainbow Trout is a springtime spawner on the Pacific slope, depositing its eggs from February to May, it has in its Eastern habitat adapted itself to the very different

Photograph by E. R. Sanborn

THE PIKE, A FRESH-WATER MARAUDER

The habits of the Pike are similar to those of the Muskellunge. It tries no tricks when hooked, but reels off the line as though relying on its sheer strength to get away.

climatic conditions prevailing there and now spawns in the fall and early winter, like the Brook Trout, but the eggs hatch in less time.

The vitality of the artificially fertilized eggs has made it possible to ship them to great distances in a half-incubated condition, after which the hatching process can be completed by ordinary fish-hatchery methods. In this way fertilized eggs of the Rainbow Trout have been sent to the Atlantic coast, to Europe, and even to New Zealand in refrigerated packages with but little loss.

This is the method now used in distributing not only Trouts and Salmons, but many other kinds of fishes.

Eastern anglers do not usually rate the Rainbow with the Brook Trout as a game fish, but we cannot believe that this criticism applies in its native rivers. It is, perhaps, true that it is there a better food fish. Anglers have their own ideas on such matters, and are not to be dissuaded from opinions formed in places where they have enjoyed good sport.

In the McCloud River we have taken three- and four-pound specimens, but the average is smaller. It is known to attain a weight of 10 pounds, especially when transplanted to warmer waters, or where the food supply and the large area of a lake provide conditions favoring greater growth.

It is probably not so gamy a fish in warm waters as in mountain streams. We have seen it leap repeatedly when hooked—a thing the Brook Trout seldom does.

The Rainbow is a fine sportsman's fish, taking the fly much like other Trouts, and is not a competitor of the Brook Trout in maintaining a place in the wider habitat now afforded it.

In some localities the identity of the Rainbow is confused with that of the Steelhead (*Salmo gairdneri*), also a Pacific coast fish, which has been successfully acclimatized in streams flowing into Lake Superior, Lake Michigan, and elsewhere. It has smaller scales than the Steelhead. In California the Rainbow is not inclined to seek the sea like the Steelhead, while the latter ranges far inland at spawning time, like the Salmon. A few Steelheads have been taken in the McCloud River 300 miles from salt water, and it is not unlikely that some of the Steelhead eggs were unwittingly shipped from there with eggs of the Rainbow.

With its broad, iridescent, purplish-red band along the side, the Rainbow Trout is well named.

EASTERN PICKEREL (Esox reticulatus)

(*For illustration see Color Plate IX*)

The Eastern Pickerel—the largest of our three species—belongs chiefly to the region east of the Alleghenies, from Maine to Florida. It reaches a length of two feet and a weight of seven or eight pounds. Two or three pounds would be near the average size, which varies, however, with the locality.

Chain Pickerel is a name much used in the North, while Jack is more common in the South. It is often confused with the Pike in waters where both are found.

Like others of the family, it leads a solitary life, except at spawning time. Pickerels cap-

tured by bait trolling in New Jersey lakes have been taken in rather shallow places, where they found shelter among water plants. Here also the Pickerel deposits its spawn. The eggs are thrown off in long masses like those of Perch and are usually seen among submerged brush and weeds. In the North it spawns in April and May; in the South it spawns earlier and grows faster.

The Pickerel stays in deeper water in winter and is then taken through holes cut in the ice.

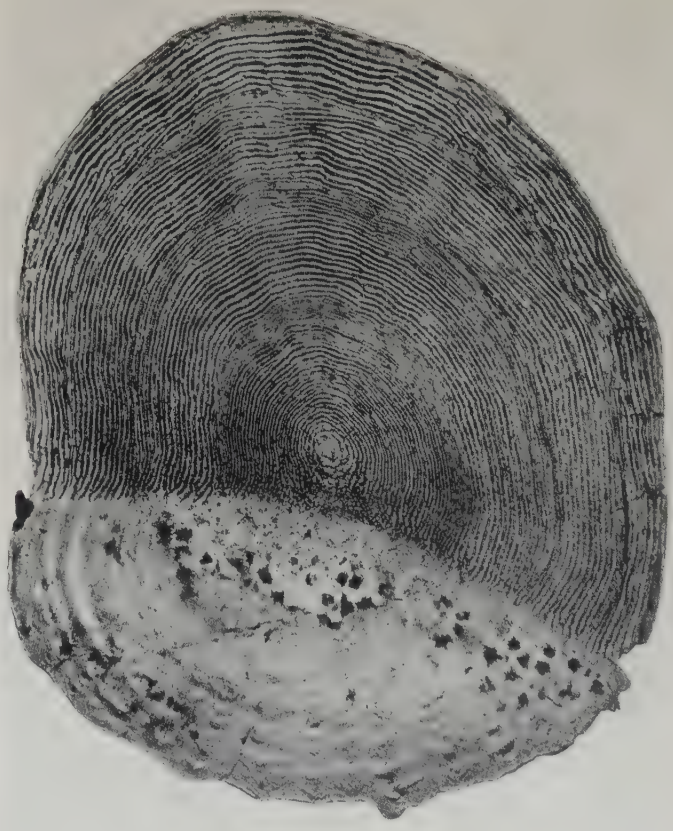
It is said that in ponds devoted to fish culture a Pickerel five years old may be a foot and a half long and weigh two pounds, but rapidity of growth depends upon the abundance of food.

The Pickerel will seize a fish half as large as itself and swallow it by degrees.

All fishes of the Pike-Pickerel family are taken by similar methods. Fishes and Frogs are good live baits and are used in trolling, casting, and skittering and artificial lures are used in the same ways.

"Skittering" is an angler's term; it is done with a long rod and a short line, by jerking the bait along the surface.

The Eastern Pickerel is probably a better game fish than either of the other Pickerels. These fishes, being rather easily caught, both in summer and winter, soon become reduced in numbers in the smaller water areas.



Photograph from U. S. Bureau of Fisheries

THE MAGNIFIED SCALE OF A DOG SALMON

This scale was taken from a mature male in its fourth year. Note the "rings," like those of the cross-section of a tree, by means of which the age of a fish can now be computed (see text, page 127).

Another species, the Banded Pickerel (*Esox americanus*), also limited to the region east of the Alleghenies, is smaller than the Eastern Pickerel, seldom exceeding a foot in length. It inhabits chiefly lowland streams and swamps, often descending streams to brackish water.

The Little Pickerel (*Esox vermiculatus*) has a shorter body and longer head than its relatives. It is a fish of quiet waters and does not exceed a foot in length. It belongs to the Ohio and Mississippi Valleys and to streams flowing into the Great Lakes.

PIKE (Esox lucius)

(For illustration see Color Plate IX)

The Pike reaches but half the size attained by the Muskellunge. It has much the same distribution but a greater range northward. The writer has taken it above the Arctic Circle in Alaska.

The American Pike is probably not distinct from the Pike of the Old World, but the latter is believed to be larger. Being more widely distributed and abundant than the Muskellunge, it is better known to anglers and is of more economic importance.

The Pike, like the others of its family, is one of the notoriously voracious fishes, destroying great numbers of other fishes and many water birds and small aquatic mammals. It is well equipped for the predatory life and is believed to eat about a fifth of its own weight daily. There is no doubt about its being the enemy of all fishes inhabiting the shallower waters. Only a few Pike can find subsistence in ponds and lakes of limited extent.

Photograph by E. R. Sanborn

THE CALICO BASS DERIVES ITS NAME FROM ITS MARKINGS

This fish is neither large nor noted for gameness, but it is the object of a vast amount of angling over a considerable part of the country. Market fishers take large numbers in the Mississippi Valley.

It is not a suitable fish for propagation in waters adapted to other fishes that are less piscivorous, and its cultivation should be restricted to such localities as are best adapted to it alone, and where it may subsist on fishes of the least value as game or food.

The Pike reaches a length of four feet and a weight of 40 pounds or more. There are several much-quoted records to the effect that the Pike of Europe and Siberia have been known to exceed 100 pounds in weight. Natives of the Alaska Peninsula told me repeatedly that Pike of enormous size inhabit Lake Iliamna.

It may be that the Pike attains its greatest size in far northern waters. In northern Alaska we found it abundant in all parts of the Kowak and its tributaries, especially in quiet lagoons leading off from the river. There were many lurking in shallow water among overflowed mosses, where we continually startled them in walking along shore.

Having little time for angling, we took such Pike as were needed for food by shooting them as they lay in the shallows with hardly enough water to cover them. This was early in August, when the cold Arctic streams are about as warm as they ever get, and the Pikes were probably spawning. In our Northern States they spawn soon after the ice leaves, and the eggs hatch in about three weeks.

The annual yield of Pike and Pickerel in the net fisheries of the Great Lakes exceeds 2,000,000 pounds. The identity of the Pike is often lost in the name Pickerel, with which it is associated in much of its geographic range.

An inhabitant of the shallower waters in summer, the Pike in winter seeks greater depths, doubtless following its food supply, and is taken on baited hooks set through the ice. In summer it is a solitary still hunter, lurking about the edges of weedy or brushy places. It is taken with all sorts of live and artificial baits, in trolling, casting, and skittering.

Many anglers consider Pike and Pickerel fishing a high form of sport and value them also as food-fishes, but there are others who think differently. We have enjoyed them both on the line and in the pan.

LAKE STURGEON (Acipenser rubicundus)

(For illustration see Color Plate X)

The Lake Sturgeon is the largest fish of the Great Lakes and, next to the Paddle-fish and the Giant Gar of the Mississippi River, our largest fresh-water fish. It never reaches the great size of the Sea Sturgeons ascending rivers of the Atlantic and Pacific coasts. Milner, who examined many in the early seventies, saw none longer than six feet, but found reports around the Lakes of larger Sturgeons. In 1922 a Sturgeon was taken in Lake Huron which measured seven feet three inches and weighed 225 pounds.

The history of the Sturgeon is a story of wanton waste. In 1872 Milner reported a fishing firm at Sandusky, Ohio, engaged in preparing smoked Sturgeon and caviar, which used from 10,000 to 18,000 Sturgeons a year. Before this firm began to utilize them the local catch of Sturgeons, which were always present in the nets, was destroyed as useless. This was also the practice elsewhere on the Lakes.

When the value of the fish was finally recognized, its decimation proceeded so rapidly that it soon became scarce and has been so ever since.

The difficulties encountered in the propagation of the Sturgeon by artificial methods have so far been only partially overcome. The breeding sizes available for experimental fish-culture are now so limited that extermination is feared.

In 1880 the catch of Sturgeons in the Great Lakes exceeded 7,000,000 pounds. In 1917 it had fallen to less than 100,000. In the upper Mississippi River and its tributaries the catch has fallen in proportion.

The Sea Sturgeons have also decreased at a rapid rate and fish-culture has made little progress in propagating any of them.

When we consider that the caviar alone from a single large female Atlantic Sturgeon is worth nearly $100, it is easy to realize what the passing of this fish means. Such is the rate at which we are harvesting our wild crops.

The Lake Sturgeon inhabits also the large interior lakes of British America, but statistics on the yield from those waters are not at hand. The small Shovel-nosed Sturgeon of the Mississippi River, belonging to a different genus, is of much less value commercially.

The Lake Sturgeon is inoffensive as far as other fishes are concerned, except as it may disturb their eggs, being strictly a bottom feeder and living on mollusks, crustaceans, worms, and more or less small plant life. Its mouth, devoid of teeth and placed on the under surface of the head, is suckerlike in form and can be protruded downward like those of Suckers. The heavy snout is used for stirring up the bottom.

Sturgeons have lived only two or three years in the Aquarium, but doubtless would live longer in captivity were it practicable to keep them in mud-bottomed pools and supplied with their natural foods. Unfortunately, aquatic animals confined under the conditions now practiced are compelled to subsist, especially in winter, on such foods as the markets afford.

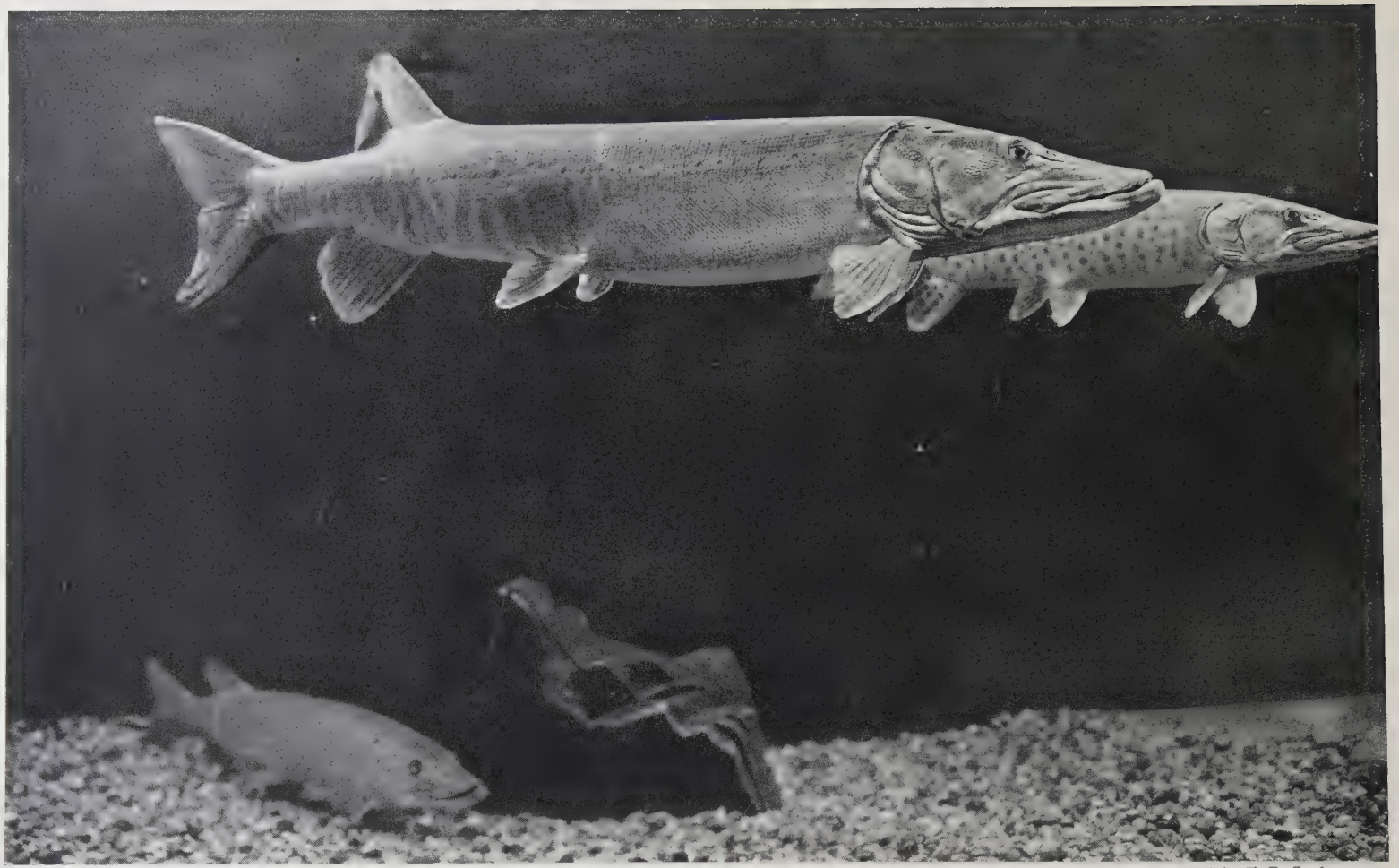
The Sturgeons are fishes of ancient lineage, the species having been more numerous in former ages, when they were more heavily armored with bony scales than are those now existing. All Sturgeons are at once distinguishable by their five longitudinal rows of heavy, bony scales.

The Sturgeon is an active fish, often leaping clear out of the water. It lives chiefly in the shallower waters along shore, where it spawns in June.

MUSKELLUNGE (Esox masquinongy)

(For illustration see Color Plate XI)

There are so many ways of spelling the Indian name of this fish that we have adopted the one apparently most in use, only after an orthographical search which revealed 24 ways of spelling it. The Muskellunge is the largest of the Pike family, being known to exceed 80 pounds in weight, while 40-pound specimens are fairly common.



Photograph by E. R. Sanborn

THE BIG AND POWERFUL MUSKELLUNGE, MOST VORACIOUS OF FRESH-WATER FISHES

This fish lies half hidden, in wait for his victim. His habit of motionless poise makes him a good subject for the camera.

It is a northern fish, inhabiting mainly the Great Lakes, Lake Champlain, Lake Chautauqua, lakes of Canada, the St. Lawrence River, and the upper Mississippi and tributaries.

It is celebrated as a game fish, having both size and strength. Unless equipped with a rod suitable for a large specimen, the angler may have to play the fish an hour before landing it.

Live bait casting and spoon trolling are the usual ways of taking the Muskellunge.

As a fish-eater the Muskellunge rivals the Barracuda of salt water, making the same fierce rushes and having a similarly large mouth set with dangerous teeth. There is, in fact, a superficial resemblance between these two widely separated fishes.

With a long, narrow body, strong dorsal and anal fins placed far back on the body, and a powerful tail, the Muskellunge is well equipped for speed. It has the look of a three-propeller craft, but the power is reserved for sudden bursts of speed, as it is not given to ranging far from its customary lair. The Muskellunge, like other fishes of the Pike family, is solitary in habit, lurking in sheltered spots, whence it darts upon its prey.

As food-fishes, neither the Muskellunge nor the other Pikes are usually rated as high as the Trouts and Basses.

The Muskellunge with which we are best acquainted is the species belonging to Lake Chautauqua and the upper Ohio River system—*Esox ohiensis*. This species has long been on exhibition in the Aquarium, where 30-pound specimens have lived four or five years at a time and would have lived longer but for accidents to the water supply. Although well fed, they have occasionally attacked their large tank mates, inflicting serious injuries. It is sometimes called Barred Muskellunge. Mr. G. A. Winchester states that the largest specimen taken in Lake Chautauqua weighed 49 pounds. Forty-pounders are taken every season, but seven pounds is about the average for that lake. A 42-pound specimen was taken in Lake Chautauqua which had a length of 52½ inches (see page 127). In this lake it is taken in summer by spoon trolling. In the autumn live baits—Suckers, Shiners, and Creek Chubs—are used.

Live-bait fishing is more effective at night and attracts larger fish. Skittering with dead Minnows is fairly successful in summer and both casting and skittering can be done over weedy areas. A good day's catch would be five or six fish. The State hatchery at Lake Chautauqua, between 1896 and 1920, turned out more than 69,000,000 Muskellunge fry.

The spawning season begins about April 20 and lasts three weeks. The Muskellunge spawns from 100,000 to 300,000 eggs, which are deposited mostly where brush, dead limbs, and logs lie in the water.

Another species of Muskellunge (*Esox immaculatus*) inhabits lakes in northern Wisconsin and Minnesota.

The members of the Pike family are readily distinguished by the scales on cheeks and gill covers. In the Muskellunge the cheek and lower half of gill cover are without scales; in the Pike the cheek is entirely scaled, the lower half of the gill cover being without scales; in the Pickerels cheek and gill cover are both fully scaled.

COMMON WHITEFISH (Coregonus clupeiformis)

(*For illustration see Color Plate XII*)

One of the most abundant and important food-fishes of the North is the Common Whitefish, which inhabits the Great Lakes and some other large lakes of the United States and British America.

There are several species of the genus, mostly of restricted range, inhabiting lakes in the Northwest as far as Alaska, but the Common Whitefish and the Menominee Whitefish (*Coregonus quadrilateralis*), also abundant in the Great Lakes, far exceed the others in commercial value.

The Common Whitefish is in the main the species on which the "Whitefish" industry is based. The catch in 1919 exceeded 6,000,000 pounds, or about half the quantity taken in 1890, so heavy is the drain made upon this food resource. The Whitefish catch along the Canadian shores of the Lakes being equal to that of the United States, we may double the above figures.

The Whitefish fortunately responds readily to artificial methods of propagation, and there are several hatcheries along the Great Lakes devoted to its increase. It is doubtless the favorite food-fish derived from inland waters. Planked Whitefish is considered as great a delicacy in the Lake regions as planked Shad around the shores of the Chesapeake.

The largest part of the catch is made in Lake Michigan and the least part in Lake Ontario. The gill net is the principal apparatus used in capture, but many are taken in pound nets and seines. The Whitefish is seldom taken with the hook, and then only with worm or insect bait.

It inhabits chiefly the deeper parts of the Lakes, moving into shallower waters early in summer, in midsummer seeking again the cooler depths. In the fall months Whitefish again come inshore to spawn, some of them entering streams for that purpose, but the migratory movements vary somewhat in the different Lakes.

Recent investigations have shown that the Common Whitefish is late in maturing, probably not spawning until after five years of age. It deposits on the average about 35,000 eggs, which hatch in about five months.

The food of the Whitefish consists of small crustaceans, small mollusks, and insect larvæ, but chiefly of various kinds of Entomostraca. Whitefish hatched in the Aquarium were carried through the critical period of infancy on a diet consisting of the larvæ of mosquitoes.

These fishes, now ten years old, have lived and grown on a diet of chopped fresh meat. Had it been possible to supply them with their natural live foods, their size would doubtless have been greater. These specimens are apparently the only Whitefishes ever brought to maturity in captivity (see page 131).

Whitefish eggs and young Whitefish are devoured in great numbers by predatory fishes.

The largest Whitefishes seldom reach a weight of 20 pounds, and such are rare, the average as brought to market being only three or four pounds. Females are larger than males.

The Whitefishes as a group are considered the most important fresh-water fishes in the world, and there can be no doubt of the fact that they are undergoing progressive depletion.

FRESH-WATER DRUM (Aplodinotus grunniens)

(*For illustration see Color Plate XIII*)

The Fresh-water Drum is a large fish belonging chiefly to the Great Lakes and the Mississippi Valley. It reaches a length of three or four feet and a weight of 40 or 50 pounds. It is a food-fish, wherever taken, and more popular in the South than in the North.

In 1899 the catch of Drum in the Mississippi and its tributaries exceeded 3,000,000 pounds; in the Great Lakes in 1917 the catch amounted to nearly as much.

The Drum is a bottom fish, living mostly in muddy waters, feeding on Snails, Mussels, and Crayfish, for which its heavy paved teeth are well adapted, and it is not given to the eating of other fishes.

It is not a popular angler's fish, but is often taken with Crayfish bait, and the young are better eating than the adults. The net fisheries take the bulk of those marketed. In the North it is often called Sheepshead, while in Louisiana it is best known as Gaspergou.

The Fresh-water Drum makes drumming or grunting sounds not unlike those made by the Sea Drum, and this is the meaning of its specific name, *grunniens*.

The noises made by Drums, Croakers, and other sound-producing fishes are accomplished by muscles drawn across the air bladder, by the grinding of their blunt teeth, and in other ways, fishes having no real vocal organs.

The ivorylike ear bones, or otoliths, of this fish are popularly known as "lucky-stones," a fancy originating in a marking resembling the letter L.

The Fresh-water Drum has proved to be a hardy fish in the tanks of aquariums, where it gets little of its natural food.

YELLOW PERCH (Perca flavescens)

(*For illustration see Color Plate XIV*)

The Yellow Perch is one of our best-known fresh-water fishes, being abundant throughout the Northern and Eastern States, especially in lakes and ponds. On the Atlantic slope it extends somewhat farther south than in the Mississippi Valley, where it is confined to States bordering on the Great Lakes.

In the North it extends from Nova Scotia and Quebec westward to Minnesota.

The market catch by nets in the Great Lakes sometimes exceeds 9,000,000 pounds a year, while anglers in towns along the Lakes take great numbers and find sport in doing so. The catch by anglers in smaller lakes and ponds everywhere is very large.

The Yellow Perch comes as near to being everybody's fish as any other and but little art is necessary in taking it. It is ready to sample all the baits of the amateur and even responds to baits let down through the ice in winter, when many other fishes are sluggish. The expert takes it both with artificial fly and trolling spoon.

As a food-fish, there is none of better flavor among the commoner kinds. It is easily identified by its broad cross-bands of black, as no other native fresh-water fish wears the same combination of black and gold.

Like other fishes of extended range, it has several names, viz., Yellow Perch, Ringed Perch, Raccoon Perch, Red Perch or Striped Perch, according to locality. Its length may be as much as 14 inches and its weight about three pounds, but such sizes are unusual.

The Yellow Perch is one of the easiest fishes to introduce into new waters. The eggs are extruded in zigzag-shaped bands, which, by the rapid absorption of water, became large masses, seen along the shores in shallow water. Employees of the Aquarium gather such masses in the ponds of Long Island in March and April, which are hatched indoors as a springtime fish-cultural exhibit, the young fry being placed in local streams and ponds.

The egg masses may be found at any time after the ice disappears, according to the latitude.

Yellow Perch have been kept 11 years in captivity on no other food than fish purchased in the markets, although its natural live foods include practically all the smaller forms of fresh-water life.

The Yellow Perch runs in schools and frequents moderate depths. It is a difficult fish to dress because the scales cling so tightly to the flesh.

PIKE-PERCH (Stizostedion vitreum) and SAUGER (Stizostedion canadense)

(*For illustration see Color Plate XV*)

The Pike-perch, perhaps better known as Wall-eyed Pike, ranks next to the Whitefishes and the Lake Trout in quality and commercial importance among the fishes of the Great Lakes, where the market catch in 1917 amounted to 4,500,000 pounds.

While the average weight of this fish in the Great Lakes is less than 10 pounds, it occasionally reaches a weight of 25 pounds and a length of three feet. In other northern waters the average is less than five pounds. The young are usually known as Blue Pike.

Although the Pike-perch inhabits clear waters everywhere in its range, it is a fish of the lakes rather than the rivers. It is found from Lake Champlain westward to Minnesota, in the interior lakes of New York, and in the Mississippi Valley, but through fish-culture operations its habitat has been greatly extended. Its range also extends well into British America.

Perhaps no fish lends itself better to artificial propagation; more than 300,000,000 were liberated from Federal hatcheries on the Great Lakes in 1921. A few millions are hatched an-

nually in the Aquarium, where the process of incubation in glass jars always attracts the attention of visitors. As handled in the fish hatcheries, a large specimen may yield 300,000 eggs.

The Pike-perch belongs to the family of Perches, although its form is suggestive of the Pikes.

While it is regarded in the markets as one of the best of our food-fishes and great numbers are taken in the net fisheries, it is highly appreciated as a game fish. The angler does not find it a difficult fish to catch and a large one will resist like a good-sized Pickerel.

The Sauger, also called Sand Pike, is a little brother to the Pike-perch, resembling it in general appearance, but in size does not average more than a quarter of its weight. It has a smaller eye, a more pointed head, and a lighter coloration. It has much the same geographic distribution.

The Sauger is a good food and game fish, taken in trolling and casting both with bait and lure. In some localities great numbers are taken with seines.

COMMON EEL (Anguilla rostrata)

(For illustration see Color Plate XVI)

The annual catch of Eels for market along the Atlantic coast from Maine to Florida exceeds 3,000,000 pounds and is worth $250,000.

Recently three barges, each more than 100 feet long and 12 feet wide, arrived at New York from Quebec with 165,000 pounds of live Eels. They were towed by way of the St. Lawrence River, Lake Champlain, and Hudson River and were 13 days in transit. The barges are virtually well-boats, or live cars, the bottoms consisting of heavy slats, with narrow spaces between to provide abundant circulation of water.

The catch is made when Eels are working toward salt water and is heaviest during the dark of the moon. The season is from July to October, inclusive.

Large as is the catch of Eels in America, it is vastly more so in Europe.

Science knows more to-day about the Eel than it did some years ago, and the missing chapters in the Eel's life history have been supplied through modern deep-sea investigations rather than in the study of fresh or coastal waters, where Eels are more in evidence.

Unlike Salmon, Shad, and other fishes which enter fresh waters to spawn, the Eel descends streams at maturity to spawn far at sea. The young Eels—three inches or so in length, called Elvers—that enter fresh waters in the spring in large numbers, and are continually working upstream, have always been known, but the stages of growth between the egg and the Elver were not.

These stages in which the baby Eel does not exceed three inches in length are of comparatively recent discovery. We here find it a thin, flattened creature, so transparent that ordinary print may be clearly read through its body. When first described in this stage it was called *Leptocephalus* and was not known to be the Common Eel.

These transparent larval Eels found at sea in the winter months grow rapidly, and by the end of the year are more than two inches long, when they begin to transform. By the time they are a year old they begin to appear in fresh-water streams as Elvers or young Eels about three inches long.

Investigations by the Danish vessel *Dana* in 1920 and 1921 have shown that the early larval stages of both the American and the European Eel are found only in the western Atlantic, at depths of 600 to 900 feet. The former spawns to the south and southwest of the Bermuda Islands, the latter to the south and southeast.

While the American Eel begins to enter fresh water at the age of a year, the European species remains three years in the larval stages before it appears as the Elver in European streams. The latter, like the American Eel, goes far inland, even passing within the borders of Switzerland.

Females with ripe eggs are unknown, the millions of undeveloped eggs carried by each female not developing while the Eels linger in fresh or coastal waters.

The Eels found far inland are always females and remain in fresh water for several years. It is only when tending toward reproductive maturity that they seek the sea. Male Eels remain in tidal waters and are smaller and less in evidence. Like females, they do not reach breeding maturity until they have passed to sea.

The great bulk of the Eel catch everywhere consists of females. It is said that all the Eels captured in the great Quebec fishery are females moving downstream.

The Eel catch in the St. Lawrence River is derived from Eels belonging to that river and its tributaries, including Lake Ontario. The Lake Ontario catch of Eels in 1899 exceeded 123,000 pounds. The annual yield of all the other Great Lakes combined seldom exceeds 2,000 pounds, the Falls of Niagara constituting an impassable barrier to all kinds of fishes.

Enormous numbers of young Eels gather below Niagara in spring and summer, but there is no evidence that they ever pass farther by that route.

The Eels of the upper Lakes may pass up by way of the Erie and Welland canals. It may be that limited numbers of Eels in the Mississippi River find means of passing into the Great Lakes. Whether Eels inhabited these lakes before the construction of canals, the writer is not informed. The fishery statistics at hand contain no records of Eels in Lake Superior.

Eels enter all American streams from the St. Lawrence River to the Gulf of Mexico. It is only the young Eels that move upstream. Adults move downstream and do not return. Both males and females die at sea after the first and only breeding season in their lives. The Eel is very prolific, each female producing from 5,000,000 to 10,000,000 eggs.

Eels are taken in other ways than with nets. "Bobbing for Eels" is done with worms strung on thread, which looped in a small bunch make a bait very attractive to Eels. They are also taken in small wire traps called eelpots, by eel-spears, and are even taken by digging and spearing in the mud, where they bury themselves in winter.

AMONG THE SKYSCRAPERS OF A HERON VILLAGE

A nearly-grown young bird in the foreground left the nest when the camera man sat down in it. This colony of Great Blue Herons is in a big sycamore grove at the southern end of San Francisco Bay.

HUNTING BIRDS WITH A CAMERA

A Record of Twenty Years of Adventure in Obtaining Photographs of Feathered Wild Life in America

By William L. Finley

Of the National Association of Audubon Societies

With Illustrations from Photographs by H. T. Bohlman, Irene Finley, and the Author

AS FAR back as I can remember, I can see the Black-headed Grosbeak that took his meal of elderberries in the tree just outside the east window. I recall the Goldfinches flocking in the autumn fields and I hear the evening calls of the White-crowns gathering in the rosebrier to spend the night. These were all friends of my childhood days. The lure of the wild birds developed into a hobby.

Later the opportunities opened for me to hunt out the haunts of rarer birds and make friends with them. Finally, I have made business out of pleasure by lying in wait with camera and notebook.

Behind the years of hunting lies an eagerness for the chase that has been fully satisfied in hunting and shooting with the camera. Outwitting has often come in outwaiting a shy subject. Some call it patience, but it is a lasting joy that has come with the quiet chances to study at bird homes and learn of the real character and individuality in these wild children of nature.

THE PAINTER'S ADVANTAGE OVER THE PHOTOGRAPHER

Years ago, in reading about Audubon and looking at the pictures in his big portfolios, Bohlman and I developed an ambition to show some of the things with the camera which this great naturalist had shown with the brush.

Our object was to secure a series of photographs of American birds that were both artistic in value and which showed the home life, traits, and habits of individual species. To achieve this aim, the search was made for typical nests of artistic setting, and when these were found, visits were made from time to time to get different stages of growth of the young birds and to make a photographic life history of the species.

We soon discovered that the skilled painter has an advantage over the photographer in many ways. The art in a bird photograph is so greatly limited by the working possibilities of the camera.

The painter may place his Heron on one side of the river or the other, plant his trees just where they produce the best effect, make the water ripple or reflect, flow east or flow west.

When the camera hunter tries for these effects, he has to search high and low for foreground or background. He has to move to suit the light. Even if he selects a good position, he never knows just when his bird subjects are willing to pose. He may try for days and weeks and not succeed in getting a combination that will make a picture.

A good bird photograph is a reflected image of facts. The reality of things, the truth, is the appeal which the photograph makes. We cannot set photography over against art. A photograph has to be studied for its own sake. It may be compared with other photographs, but not with creative work of pen or brush.

In considering the photograph from an artistic standpoint, we have to take into account the relation between the camera, which is a mechanical means of expression, and the ideas expressed in the picture. Because of the difference in the means of expression, we cannot compare a picture made with a camera to a painting made with a brush.

In wild-life photography one generally has to take what he can get. Yet this is not always so. One may often obtain photographs of artistic value by combining a technical knowledge of the camera with a sympathetic study of nature. He

THE CAMERA HUNTERS CORNERING A DUCKLING IN THE MARSH

A baby Duck is quick at diving and darting, and it is hard to catch him still a moment in order to get his picture. He begins to hunt his own living the day after he is out of the egg.

may sometimes select his position and his subjects; if he has the patience to wait hours and maybe days, he can get the make-up of his picture.

This we did in the case of the Caspian Terns nesting on a tule island in Lower Klamath Lake, Oregon. We set our camera, carefully concealed in a blind, to get a small bunch of tules in the foreground and the lake in the background. With this combination for a picture we exposed plate after plate at the Terns flying past. Out of 20 exposures one was successful.

In southern California Mrs. Finley and I tried for days to get a combination picture of Gull, clouds and waves. Both Gull and waves were moving so rapidly that the highest speed was necessary. The distance between the two objects made it impossible to get both in focus at once. With the bird near enough at hand to show clearly, one had to forfeit the clearness in the balance of the picture. Whenever the waves were breaking just right, it was almost impossible to catch a Gull in the right position and *vice versa*.

THE GREAT BLUE HERON IS AN ARTISTIC POSER

Some birds make up much better in photographs than others. The attitude of the Great Blue Heron at rest is in itself artistic. While photographing in a colony of these birds in the San Francisco Bay region, we hunted for several days to select a position that would have an artistic make-up. The best we could find was the outermost branches of a tall sycamore.

The only viewpoint for the camera was from the top of an adjoining tree. At this place we had to erect a small stand and tie the camera in position. The distance was too far for the regular lens, but with the telephoto attachment a good picture was obtained after the old Heron returned from fishing and perched on a dead limb at the side of her nest (see page 173).

The first trips of any consequence that Bohlman and I took to study bird life were in 1897 and 1898. During the summers of these years we made two long canoe trips to the headwaters of the Willamette River and into the mountains. In the summer of 1899 we cruised Lewis River in Washington as far as Tum Tum Canyon. During this trip we were capsized in one of the swifter rapids and lost the camera and part of our equipment.

STUDYING SEA BIRDS FROM ROCKY CLIFFS

Our first intensive work in making photographic studies of wild birds was one summer, when we were landed on some of the rocks off the Oregon coast by sea-lion hunters. At this time we had our first glimpse of the great colonies of birds that lived on the sea cliffs.

We decided to return at the first opportunity and make a careful photographic study of the sea birds. This could not be done in a day or several hurried trips, so we decided to hazard a camp on the ledges and stay until we could complete our work.

Two years later we pitched our four-by-seven tent on the beach opposite Three Arch Rocks. Although it was the latter part of June, the sea winds were cold and the rain continuous. Occasionally the sun would break from the clouds for a day and our hopes would rise as the size of the breakers diminished, but this would be followed by a sou'wester that brought a steady drizzling rain and lashed the white caps as high as ever. We were wet half the time, but did not catch cold. We soon reached a sort of amphibian state, where a condition of water soak was normal.

Three Arch Rocks are about a mile offshore. These great stacks of basalt, so named because each has a huge arch through the base, are the largest islands off the Oregon shore. They lie two and a half or three miles north of the narrow entrance to Netarts Bay and about six miles south of the entrance to Tillamook Bay.

We had but one way of reaching the rocks, and that was by means of a 14-foot dory. We tried twice to go out over the bar, but we were not able to discover a break in the oncoming line of combers. The treacherous current nearly wrecked us on the outer spit. We decided the only way to get out from the ocean beach was to land our dory in the surf at a point opposite the big rocks.

For 16 days we lay in camp while the waves throbbed incessantly. We often lay awake at night, hearing the rain beat on the canvas and listening to the wind,

trying to imagine the growl of the surf was growing fainter.

Every morning we crawled out in the gray light to see if we could detect a gap in the line of breakers. We lay in the sand by the hour with our field glasses, looking at the bird world offshore. The longer we looked, the more alluring the rocks became.

One morning, when we had grown impatient, we tried to drive our boat through the lowest place in the surf barrier. We waded in with our little dory until she floated. Watching our chance, we jumped to the oars. The nose of the boat plowed through the foam of the first and second breakers, but they tossed her like a toothpick. She shot at the third like a hunter at a fence, but failed to reach the top before it combed. Crash! came half a ton of green foaming water down my back.

We swerved a little to the right and another monster rose like magic. Several tons of the next wave piled over us, and the third tossed us shoreward empty as a cracker box. We had taken the precaution of wrapping our camera equipment in water-tight bags and tying them in the boat. We dried out the rest of the day and went at it again the following morning, with about the same success. The next day the surf dropped lower and we reached the smooth water beyond.

A BABEL OF WILD-LIFE VOICES

As we pulled near the rocks the air-laden guano smell struck our nostrils. The babel of distant sounds was broken by the scream of a near-by Gull or the roar of a sea lion. As we approached the lowlying rocks, the huge hulks of sea lions were stretched like logs thrown up by the tide. The ranks grew thinner as they receded from the water's edge, till the topmost ledges were held by three lumbering bulls. They were all alert. They dragged themselves along the shelves on their elbows as a person would whose hands and feet are tied.

The bellowing grew louder and louder, until one would have thought the foghorns of a fleet of battleships had suddenly broken loose.

Mingled with the roaring of the bulls were the bleating of a hundred calves and the cries of thousands of sea fowl that scurried overhead like swarms around an arc lamp in May-fly time.

We could not talk above the din. When we got nearer, many of the lions wabbled to the edge of the ledges and rolled off in the water. Those nearer the top came down the slope in a series of jumps that ended in a splash. The last old bull on the top left slowly and defiantly, like a captain reluctant to leave his sinking ship. Two mothers and a crowd of babies stayed.

Far up under the eaves of those great stacks of basalt we could see the California Murres whirling and flashing in circles. Thousands sat in long white waistcoated lines on every available shelf, as if on dress parade. Others splattered over the water and dived about our boat.

Squadrons of pug-nosed Puffins with short wings and roll-shaped bodies buzzed about the crags like bumblebees. White-winged Gulls, curious and cackling, followed our wake. Ungainly Cormorants flapped solemnly away, while others returned strung out in Indian file. Far up the sides, and penciled against the blue sky, we could see their black regiments standing at rigid attention beside their nests and eggs.

We decided to land on the south side, where the rock shelved down to tide level. A steady ground swell of 10 or 12 feet would not let the boat touch the rock. As the wave receded, we backed in and one of us landed in a flying leap, while the other pulled away to keep from being dashed against the jagged rock by the next breaker.

Provisions had to be tossed ashore. Some of our bulkier belongings barely escaped a watery grave. The hardest task was in ledging the boat. We swung her well in on the crest of a big wave, jumped, and held her as the water receded; then, with block and tackle, we worked her up to a 12-foot table away from the lash of the waves.

Looking for a camping spot on the rough side of the cliff was a good deal like hunting for a lodging on a winding staircase. There was but one spot wide enough to stretch out upon, about 40 feet up from the landing place. We awoke the next morning feeling as if we had spent the night on the top of a broken picket fence.

THE AUTHOR'S FRIENDS, A FAMILY OF DESERT SPARROWS

Little Johnnie, in the rear, was afraid his turn would never come; but he got the next mouthful. While these young birds looked alike, the mother knew one from the other, especially at meal time.

A GOOD WING SHOT OF A FEMALE PINTAIL DUCK

Shooting with a shutter is many times more difficult than shooting with a gun. The camera was hidden in a blind and the photographers waited all day before getting this picture.

A ROAD RUNNER, OR COCK OF THE DESERT

A typical bird of the cactus country of the Southwest bringing in a whip-tailed lizard to her young in a cholla cactus. Her larder contained four kinds of lizards.

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YOUNG GOLDEN EAGLES READY TO BREAK HOME TIES

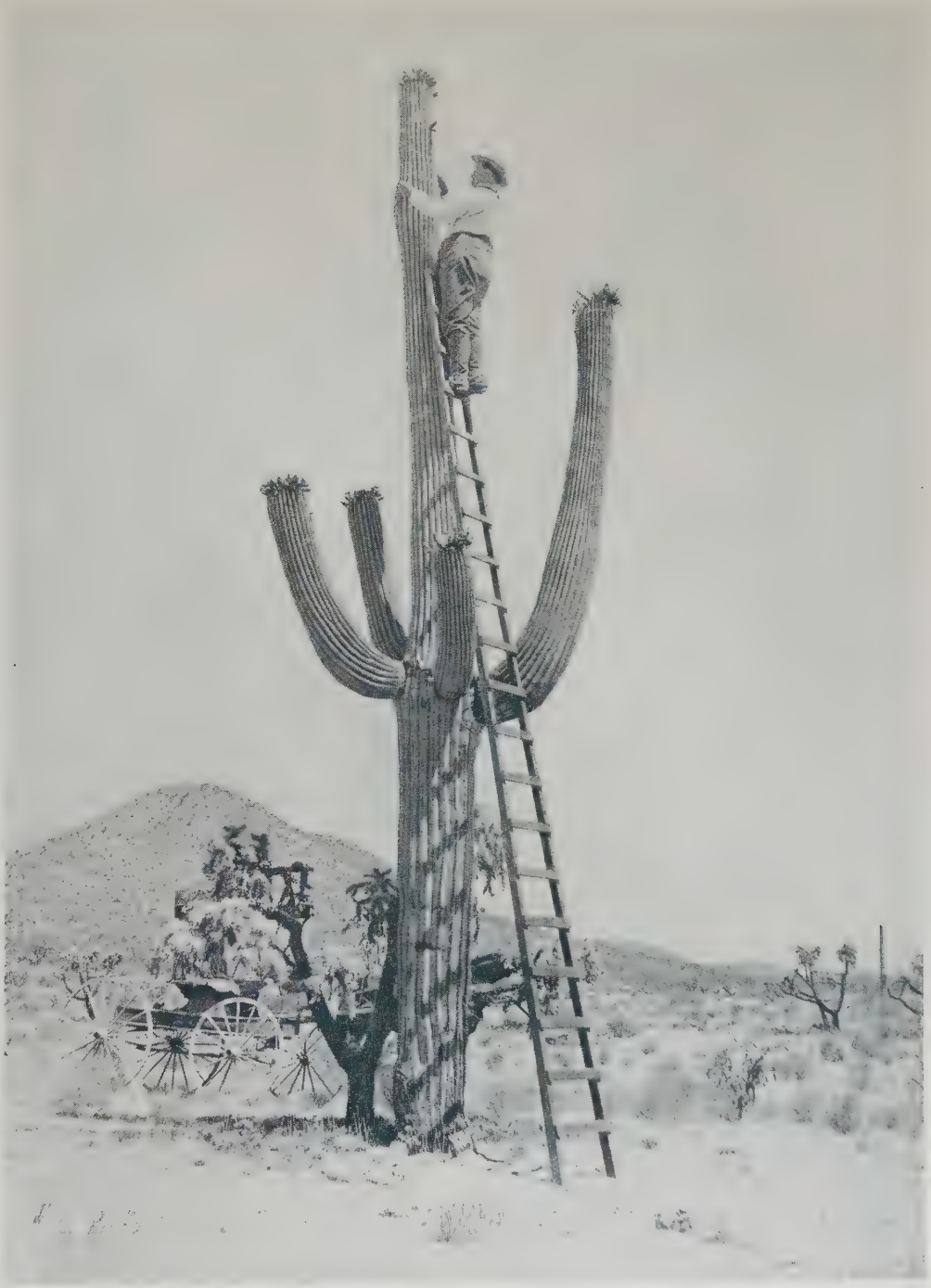
There are two species of Eagles in the United States—the Golden Eagle, nearly exterminated east of the Mississippi, and the Bald Eagle, our national bird. Alaska is trying hard to reduce the number of the latter. Her bounty law has caused the slaughter of about 12,000 Eagles to date. The salmon canners claim that the Bald Eagles catch many fish and are destructive to fur-bearing animals and reindeer fawns.

"THE BENEDICTION"

A parent bird is seen alighting in a colony of half-grown young Pelicans crowded together like children in a day nursery. As a rule, there are two young in each family.

A DANGEROUS CLIMB AFTER SEA BIRDS

California Murres live on the inaccessible ledges of the sea cliffs. Through the efforts of the National Association of Audubon Societies, these rocks off the Oregon coast were set aside as a Federal reservation for sea fowl by President Roosevelt in 1907.



VISITING THE HOME OF AN ELF OWL IN ARIZONA

The tiniest of all Owls, about the size of an English Sparrow, generally takes a deserted Woodpecker's hole in the top of a giant cactus. No one could climb such a tree, but a 25-foot ladder reached the nest-hole.

A WEDGE OF WHITE PELICANS

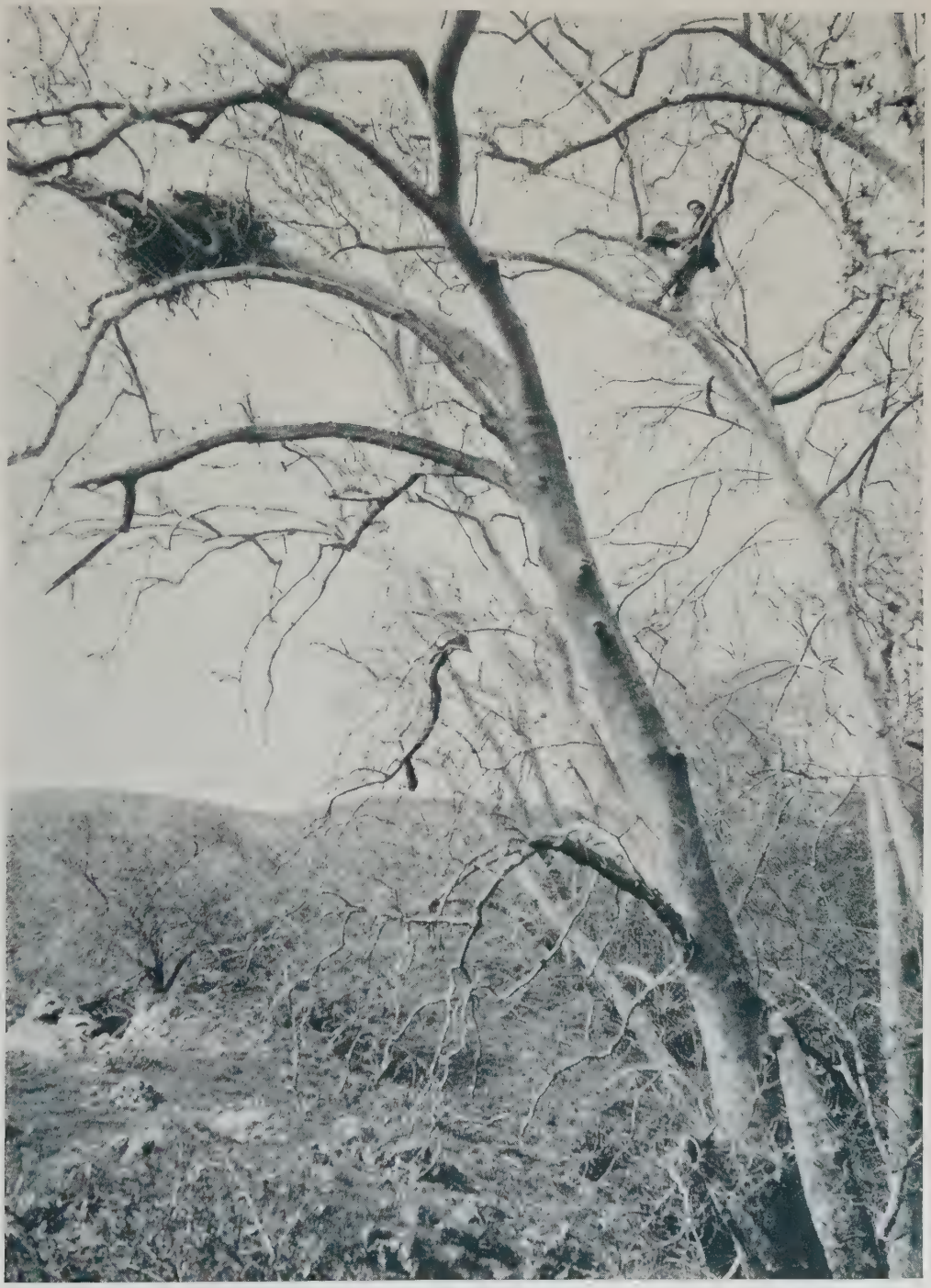
No ship will ever sail the skies with the grace and beauty of a White Pelican. While ungainly in appearance, a flock of these birds winding slowly among the clouds is a sublime sight. The wings, partly black in color, make a showy contrast with the white of the body.

GREAT BLUE HERON ON GUARD BY HIS NEST

This bird is sometimes erroneously called "Crane." He has long legs for wading after fish and frogs, is about four feet high and, if he were subject to human ailments, would have about 12 inches of sore throat.

A LONG CLIMB TO A RED-TAILED HAWK'S NEST

A Red-tail likes to get the highest place for his aerie, so he can have a good outlook. This one, in the central part of California, was 80 feet from the ground in a eucalyptus tree.



PICTURING THE AERIE OF A GOLDEN EAGLE IN CENTRAL CALIFORNIA

The big birds had carried a cartload of limbs and sticks and built a platform nest, five feet across, strong enough to support a man.

A YOUNG AVOCET AT HOME IN THE MARSH

The Avocet is a resident of the great marsh areas of the West. His skirts are cut short for wading and he moves along in the water, swinging his bill from side to side, hunting for water insects.

CALIFORNIA CONDOR ALIGHTING ON THE MOUNTAIN SIDE

The Condor is the largest bird that flies and also one of the rarest. He weighs from 20 to 25 pounds and has a wing spread of 9 or 10 feet. When under sail, a bird of this size always has difficulty in making a safe landing.

A FAMILY OF HALF-GROWN BURROWING OWLS

These Owls are associated with prairie dogs and ground squirrels. The nest is always several feet under ground in the deserted home of one of these animals. It was formerly reported that birds and rodents lived together in the same burrow, but this is not true.

GULLS ON AN ANCHOR CHAIN

These birds are at home along the waterfronts of our seacoast cities, where they live during the fall and winter, picking up waste scraps of food. In summer they nest in colonies on the islands of inland lakes or on the sea rocks off the coast.

A COVETED PLACE ON THE BOWSPRIT

Gulls live about a ship as a robin does in a garden. They will coast along at the stern of a steamer for days to get a meal of choice "seconds" thrown out by the cook. There seem to be reliable records of Gulls following the same vessel from the Irish coast to New York, a distance of 2,560 miles.

On the next two flats just above ours were two large "chicken yards" of Murres. The clamor of these quarreling birds lasted long into the night and began with renewed vigor at daylight.

Although everything was open in camp, the ventilation was vile. The whole island was rancid, in spite of the airing it got from every wind of heaven.

After breakfast we started out, Robinson Crusoe-like, to explore the rock. This rose in abrupt cliffs from the sea, but the south side, upon which we were camped, was well ledged.

By climbing from shelf to shelf and zigzagging back and forth, we found a way to the top. One shelf had to be scaled with a rope. At another a projecting knob enabled one to look straight over the drop for 150 feet, and around this we had to edge our way. A little above was a portion of the cliff that was crumbly and broken. Here we climbed from the nest of one Cormorant to another and clambered on up to the pinnacle of the rock, where we could get an idea of the size of the island.

GULL SCRATCHES HIS EAR WHILE ON THE WING

One of the prettiest sights about the rock was the Gulls, which filled the air like so many feathery snowflakes. Their immaculate white bodies and soft gray wings tipped with black were delightful to see.

I liked to watch them because they were masters of the air. There was a constant adjustment of wings to meet every air current that struck the rock; but in a steady breeze the movement was too slight to see and they hung motionless, as if in a painted sky. They tacked straight in the teeth of the wind. I saw one retain perfect poise and at the same time reach forward with his foot and scratch his ear.

A Gull in his own country will steal and murder like a pirate. If a Murre or Cormorant left its home without a guard, these saintly looking scalawags swooped down to eat the eggs and young.

The Murre has a large, tough-shelled egg which the Gull's bill cannot penetrate. But these robbers know enough to pick it up, fly out, and drop it on the rock below or nose it along until it drops to the shelf below, when they can devour the contents.

Oftentimes I have seen a Gull pick up a young Murre or Cormorant not long out of the egg and swallow the youngster alive. The downward course of the young bird was marked by a bulge in the Gull's neck.

I have often seen a Western Gull act in a way that speaks well for his sagacity. I have watched him open clams and mussels at the seashore. His bill is unfitted for crushing the hard shell, but he will take a clam, rise to a height of 30 feet, and drop it to the hard sand and gravel below. If it doesn't break, he will continue the performance. I saw one bird do this 15 times before he was successful.

PETRELS BUILD ANNEXES TO PUFFINS' NESTS

The roof of the island rock is covered from one to three feet deep with a loose coating of earth. It is fertilized with the guano of countless generations of sea fowl. From this sprouts a luxuriant growth of chickweed, clover, and other grasses.

The whole surface is so perforated with the burrows of Tufted Puffins, Beal Petrels and Gray Fork-tailed Petrels that one can scarcely walk without sinking into the nests.

The Puffins dig in from two to three feet, and a burrow will often have two or three openings.

A Petrel sometimes uses the door of a Puffin's nest as an entrance and digs himself a kind of a side bedroom off the main corridor. It is not unusual to find one or two Puffins along the main hallway and a couple of Petrels lodged in the attic.

A near front view of a Tufted Puffin is more like a modern battleship than a member of the feathered tribe. It has a huge red and yellow bill and long yellow curls. According to the Lamarckian theory, the bird has been doing nothing since creation but sit around on the rocks and bite open clams and mussels (p. 195).

PUFFIN PROVES A VICIOUS BITER

My first experience with an old Puffin prejudiced me. I wanted a Puffin's egg, so I dropped on the ground, thrust in my arm to take one, and was somewhat taken in myself. I thought at first I had run my hand into a beaver trap. I couldn't get loose until I dug the beast out and

A WHITE PELICAN LEAVING A COLONY

This species is larger than the Brown Pelican, having a wing spread of eight or nine feet and weighing 15 or 16 pounds. The bird rises with difficulty, but, once under way, sails with surprising ease and grace (see page 172).

pried her jaws open. She cut through the flesh to the bone. The odds are always against your getting an egg if there is an old sitting Puffin hen in the hole.

We might have lived on the rock for a month and climbed over it every day and not known a Petrel was there, if we had not found their hiding places. They are nocturnal in their nesting habits and are never seen about the rocks in the daytime. By digging in the soft earth, it was not difficult to unearth Petrels and their nests. One of the parents stayed in the burrow.

The Petrel nestling is fed during the day by one of the parents thrusting its beak down the mouth of the young bird and injecting a yellowish fluid. The old birds become expert at this. If you take one out of its burrow, he will immediately "play Jonah" in your direction with surprising power of projection. A dose of rancid fish oil shot up your sleeve is not pleasing!

One evening we made the dangerous trip to the top of the rock and hid on the north slope. At the last gleam of daylight the Petrels, returning from the open sea, swept in upon the island like a swarm of bats. Those in the burrows came chittering out to meet them.

The ground beneath seemed full of squeakings and the air with soft twitterings and whistlings. We felt the breath of swift wings, but not a bird could be seen, not even a shadow. Here were acres of nesting holes hidden down in the tall grass and in the darkness of the night; yet each bird had some inexplainable way of finding his own front door in this hidden city.

The novelty of our situation had a great deal to do with relieving the hardships and dangers we had to undergo in living for five days among the sea birds on the vertical side of the rock island.

We had two 10-gallon casks of fresh water. We could have lived here as long as the water lasted, for it was easy enough to catch fish and we had an unlimited number of eggs. We had various kinds of omelet, according to the species of birds on the island. Fresh Murre eggs were excellent for cooking purposes, and Cormorant eggs, hard boiled for luncheon,

THE PELICAN YAWN

The Pelican has an elastic bag or pouch that hangs from the lower part of the bill. This is used as a dip net. The bird swims along, up-ends, and dives for a fish. It was formerly thought that this pouch served to convey live fish, swimming in water, to the little Pelicans at home; but it would be impossible for a Pelican to fly with his burden so out of trim.

A YOUNG PELICAN GETTING HIS DINNER

A mother Pelican regurgitates a fishy soup and the baby helps himself out of this family dish. When he is half grown, the mother opens her mouth, and his whole head and neck disappear while he hunts for his dinner in the internal regions.

A FEAT IN TREE-TOP PHOTOGRAPHY

At the aerie of a Golden Eagle when the nestlings were nearly grown. One camera man had to climb over the nest to the end of the limb beyond. This photograph was not taken by a third person, but a second camera was tied in the top of the adjoining tree and the shutter released by a long thread.

are better than chicken eggs. The white of the egg is not white at all but a transparent blue of gelatin consistency and is very edible.

NO POETRY IN A SEA-BIRD RETREAT

There is not much poetry on the island. A nature lover who might fall into ecstasies over a song bird in the woods would receive a severe jolt the minute he came near an ear-splitting Murre colony or got the faintest whiff of the atmosphere.

We could not climb along the ledges an hour without risking our lives in a dozen places. While camped on the rock, we wore rubber-soled shoes, so we could hang or cling to the surface with some degree of safety. Even with these, we often found our toenails instinctively trying to drive through the soles of our shoes to get a better hold.

Up and down the ridge of the rock was a large colony of Brandt Cormorants, birds commonly called Shags. Their nests were scattered a few feet apart for over 100 yards. The nests were built up in funeral-pyre fashion by the débris of past generations, grass and seaweeds, fish bones, and the disgorged remains of banquets. In every nest were four or five eggs of skim-milk bluish tint, over which it looked as if an amateur whitewasher had smeared a chalky surface.

When I first looked at a motley crowd of half-grown Cormorants, I thought Nature had surely done her best to make something ugly and ridiculous. They stand around with their mouths open and pant like dogs after the chase on a hot day. Their throats are limp and flabby and shake at every breath. Their bodies are propped up by a pair of legs with a spread of toes as large as a medium-sized pancake.

The youngsters have no very clear notion of what feet are for, at least on land. If you go near, they go hobbling off like boys in a sack race.

It is not uncommon for young birds to fall over the ledges of the cliffs, where the population is so crowded. Late one afternoon, while preparing our usual meal at our camp, which was partly protected from above by the overhanging rock, we were startled by an avalanche of loose gravel. We jumped for cover as a half-grown Cormorant came flopping down and landed with a thud in a heap at our feet. He came from one of the nests about 75 feet above.

Such a fall would have broken every bone in the body of an ordinary creature. The newcomer got up a little dazed, twisted his neck in a few grotesque curves, as if just waking up; then he climbed over our pots and pans to the end of a board which served as our dining table, crept up close to our fire, drew in his long neck, and went sound asleep.

The California Murre is by far the commonest bird on the rocks. It crowds together in immense colonies. The bird lays a single egg in the open, with no sign of a nest, not even a bit of grass or a stick to keep it from rolling. Its peculiar shape helps to keep it in place, even on the bare, sloping rock, and if it is accidentally started down grade by the movement of a bird, it does not roll straight, but swings around like a top on its own axis and comes to a standstill a little lower down.

EACH BIRD KNOWS HER OWN EGG

My first impression as I looked at the colony of Murres crowded together on the shelf of rock was that the nesting must be communal. All about lay eggs so close together that one could hardly step without crushing them. Thousands of eggs, and yet no two alike! The combined effect was that of a whole spring flower garden of tints. Some were of a pure white ground color, others had various washes of gray or brown, and still others showed a dozen shades of blue.

Upon this ground was spread, in most instances, an elaborate pattern of splotches of all sizes and shapes, sometimes thicker on the large end and sometimes on the small end—splotches of brown, gray, and velvety black. Often they were marked all over. Some were daubed as with a brush; others scratched from end to end, as with a pen, and finished off with wild flourishes and scrawls. How, among so many, could any bird recognize her own?

How, in the vast throng of individuals, did she even find her own mate? To my dull human sight they all looked alike. I was unable to pick out a single bird that I could recognize if I turned away and looked back a moment later. And as

TWO YOUNG ROAD RUNNERS AT LUNCH

When a young Road Runner eats a lizard, he has a meal 10 or 12 inches long. He sits like a man with a board up his back and eats by inches, the lizard disappearing at the rate of about an inch every two minutes.

I watched them coming and going, it seemed to me at first as if each female was satisfied to plant herself on the first egg she found and, like any barnyard fowl, did not care a fig whether she or her neighbor had laid it.

But I soon became aware that such was not really the case. From my vantage ground I could see every movement in the ordinary run of life in the big colony without in any way disturbing the birds.

In order to discover whether or not it was within a Murre's limited intelligence to know her own egg, I experimented several times by scaring the birds from their nests and watching their return. Almost before I was hidden, the first Murre pitched awkwardly in. She sat for a few moments clucking and craning her neck, then hobbled up the rock past two eggs, bowing and looking about. She stumbled on as clumsily as a boy in a sack race, stopping and cocking her head from side to side like a nearsighted old lady, until she had passed eight or nine eggs. Finally she poked one gently with her bill, looked it over, and tucked it under her thigh. By this time the ledge was full of Murres, all cackling, pecking one another, and shuffling about in search for the one and only egg.

EVERY CHICK TO ITS OWN PARENT

Two years later I tried a similar experiment on the same colony when all the eggs were hatched. It had been noisy during the days of incubation, but it was bedlam when the Murres had young. As soon as the parents were scared from the nest, the infants began to squeal, and kept it up until the parents came back. When the first mother bird returned she bowed elaborately and uttered a series of calls varying in tone from the deep bass of a man's voice to the cackling of an old hen. After standing there for a few moments she straddled a few feet closer and began once more to bow and call.

Some of the young waddled down to meet their parents, squealing like a litter of pigs that had just been gunny-sacked. One crawled hurriedly down to get under an old Murre's wing, but she gave him a jab that knocked him backward and sent

A PET ROAD RUNNER SWALLOWING A LIZARD

A lizard is always eaten head first and when he once starts down a young Road Runner's throat, his scales prevent him from backing out. The head is digested first and in a short time the tail disappears with a final gulp (see text, page 201).

him looking for his real mother. She looked at two more that sat screaming, but passed them by and knocked another sprawling out of her way. At last a chick came up that seemed to qualify, for she let him crawl under her wing. Moreover, the same thing seemed to be going on in every part of the ledge, and I did not see any of the old birds accept a chick until after calling and looking around for several minutes.

The result of these experiments seems to prove that scientist right who, some years ago, claimed that nature has not lavished pigment on the Murre's egg without purpose, but that the wide variation in size, shape, and color undoubtedly helps the Murre to recognize her own. After the eggs are hatched, the difference in pitch, volume, and quality of the voices may tell the mother which chick belongs to her.

It is most interesting to watch the arrival of a Murre mate as he comes from the fishing ground to relieve the brooding mother. Sweeping in on swift wings, he begins to slacken speed when about 20 feet from the ledge, drops his legs, and back-paddles as awkwardly as a man who slips on a banana peel; and he lands sprawled out on the rock much as the man lands on the sidewalk.

Then, like a person anxious to penetrate a Fourth of July crowd, he looks for an opening in the dense front ranks. Seeing none, he boldly sets out to make one by squeezing in and shoving from right to left. The neighbors resent such behavior by pecking him, but he presses on, amid opposition and complaint, until he reaches his mate.

They change places and he begins his vigil on the egg. His mate, instead of taking flight from where she stands, usually goes through the same proceeding in reverse order until she reaches the outer edge of the rock and makes a quick launch seaward.

SEEKING THE HAUNTS OF THE WILD GEESE

When a boy I had watched the wedges of Geese cutting southward each autumn and the other flocks of wild fowl winging silently on their way. Each spring I

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A RUFOUS HUMMING BIRD TAKING LUNCH ON THE FLY

He dropped into the garden like a shooting star. By our filling the flower cups with sweetened water, he was lured to the geranium and "shot" by the camera man.

saw the bands returning. How these sights kindled my imagination, these processions, so full of mystery, that moved up and down the highway of the clouds!

The land where these flocks lived lured me like "castles in Spain." It was a lure I have never forgotten.

One spring we followed the trails across the southern tip of the Cascade Range from Ashland, Oregon. The morning of the fourth day we came down the eastern slope to the edge of a ridge that overlooked the basin of the Lower Klamath.

Stretching to the east and south, almost beyond the limit of vision, lay the marshes. The Klamath River threaded its way in and out of the green maze. Beyond were the Lower Klamath and Tule or Rhett Lakes, cutting at the lower end into the lava beds of northern California. To the northeast lay the great basin of the Upper Klamath.

Here lay the land of my dreams. After nearly 20 years of waiting, I was looking out over this place of mystery that lay far beyond the northern rim of my home hills.

From the distance where I stood the marsh was a level sea of green. As I discovered afterward, it was absolutely deceptive as to its real character. The ocean surface tells nothing of its thousand hidden wonders; so the marsh. The plain yields to the plow, the forest to the ax, but the unmeasured stretch of these tules is the same as when Lewis and Clark blazed a trail into the Oregon forest.

I hope the marsh will defy civilization to the end. The trapper and the hunter have plied the streams and the water of the lake itself, but the tules lie untouched, a maze forbidding, almost impenetrable.

The lure of the tule marsh was in its wildness. It is the ancestral nesting ground of many species of wild fowl.

We camped at the edge of the marsh that night, and early the next morning bailed out an old trapper's boat and paddled slowly down the right bank of the tule-lined river.

There were many sounds. The Red-winged and Yellow-headed Blackbirds fluttered in and out and swung on the bending tops of the tall cane. A male

A MEXICAN GROUND DOVE DEFENDING HER HOME

While a Dove is a shy and gentle bird, here is a case where the mother raised her wings and slapped the intruding finger whenever it came near her home.

Yellow-head lit on the tules just a few feet ahead. He began like the peeping of a young Duck, but, as his tail spread and his throat swelled, his song grew more violent, till it ended with a contortion like the complaint of an old sitting hen when she is disturbed. Some one has given this human interpretation to the song, which should be drawled out slowly: "Pop! goes the weasel."

As I edged silently along close to the reeds, I came to a turtle lying asleep on a water-soaked log. He didn't see me till I touched him on the back; then he awoke with a start and slid into the water. Once or twice I saw a snake glide away among the tules.

All the time I had been coming nearer to a place where a Bittern was pumping. He was a ventriloquist, for when I thought he was 20 feet away, I still sneaked 50 feet nearer. "Punk-a-lunk! Punk-a-lunk!" he said, but this pumping was only the end of the call. The beginning was a "blub, blub," like water bubbling down into a big empty cask.

As I pulled myself along by the overhanging tules, suddenly I was face to face with the Bittern, and up he flapped with a frightened "quork."

At the next bend in the river I waded out through two feet of water to a small grassy island in the midst of the swamp. I was sure I would find Ducks' nests in a place like this, but a Duck's nest is not easy to find.

I had been wandering around for some little time, wondering why I could not find a nest, when suddenly a female Mallard flushed from between my feet. I had straddled a nest of 10 eggs before the mother flapped off lamely through the grass. I was surprised at the boldness with which she froze to the nest. It is a common trait. Twice during the morning I planted my feet within a few inches of a brooding Duck before she left her home.

Ducks are loath to reveal the location of their nests, but after the eggs are once discovered they become wilder, generally flying as one approaches within 15 or 20 feet.

The next day we started out again down the river. In the afternoon a bank

THE PORTRAIT OF A GREAT BLUE HERON FROM BELOW

The eyes of a Heron are in the lower sloping side of his head. He can stand as still as an old stick in the water and yet, without the side turn of his head, see a minnow that swims past his toes.

of clouds began to rise in the east, and we heard the distant peal of thunder. We hurriedly started back, but the wind was soon lashing the waves into whitecaps. Before long the advance drops began to strike us.

It was impossible in the midst of the marsh to haul the boat out and crawl under. The nearest cover was our small tent, two miles away; so we wrapped the cameras in our coats and put our strength to the oars.

We were suddenly enveloped in a shaft of green light as the sun broke through a rift in the clouds. There were green shades in the water, backed by the darkening of the pouring rain. Then over the wide stretch of the marsh the birds began to rise — white-winged Gulls, Red-head and Teal Ducks, all winging up and away to their nests and young.

Gaunt Cormorants lifted from the surface and beat along over the water, leaving a trail of little splashes in their wake. Terns began to cry and flit up from all sides, and here and there along the sedgy water's edge, a Bittern or a Night Heron rose with a frightened "Quork! Quork!" and was away with the gale. Blackbirds were all a-flutter, as the rain and hail began to pelt.

The whole surface was a-splatter with the flood of the clouds pounding the river below. Ahead and back and all about hung a misty spray from the clashing waters.

SLEEPING AMONG WATER FOWL

After spending two weeks along Klamath River, we set out overland for Klamath Falls, and then went to the town of Merrill, 20 miles south. Here we secured a staunch rowboat, loaded in our supply of provisions, and started down Lost River for Tule or Rhett Lake.

That night we camped at the mouth of the river, a great rendezvous for water fowl. Avocets were swooping past with a loud "Whit-whit-ie! Whit-whit-ie!" Stilts were crying "Quit! Quit!" loud and fast, and Killdeers running and flapping about in great distress. They kept crying long after we had crawled into our blankets and well into the night. The next morning we discovered the reason, for we found four nests of the Killdeer and five of the Stilts and Avocets near by.

Toward evening the Ducks came in from the lake in bands and settled down for the night where the reedy bogs lay scattered about and the water was shallow. At dusk we lay in camp and listened to the rush of wings, as the night-comers flocked in to their resting places. We could catch the faintest whir at first, which increased to a loud swish as the band passed. Out on the water came the light flappings, as flock after flock settled for the night.

After five days we set out across Tule Lake, and after rowing several hours came to the peninsula at the southeast end. This, as well as the other region to the south, is of volcanic origin. The shore is rough and precipitous. In some places the cliffs start abruptly from the water's edge; in others disintegration has been rapid, the rocks shaling off and rolling down until there is a long, steep slope of crumbly débris in which it seems impossible for anything to grow. Yet in places these slopes are massed with California poppies.

That night we camped just below the crater of an extinct volcano and early the next morning paddled out to a rocky island containing a colony of Farallone Cormorants. In a space of 25 or 50 feet we counted 190 nests, containing about 300 young birds and half as many eggs.

Rowing past Rattlesnake Island, we came to Bloody Point, a butte of red lava almost entirely covered with poppies.

In the afternoon we made camp across from another large colony where Cormorants and White Pelicans were nesting. The Cormorant nests were built of sticks. The Pelicans merely made depressions in the sand for their eggs. In addition to bird residents, the island was well stocked with fleas.

CAMPING IN THE MARSHES OF AN ALKALI LAKE

When we returned to Merrill we loaded our boat into a wagon and hauled it to White Lake, a long body of alkali water that empties into the Lower Klamath at the southeast end.

The Lower Klamath is very different from the south end of Tule Lake. The whole border is an impenetrable jungle. Tules grow from 10 to 12 feet high. One can never get to a point where he can look out above the tops and see where he is going. The foundation is made of decayed vegetation and is treacherous to tread upon. In places the roots form quite a substantial raft. One may walk across the wavy surface, but any moment he is liable to sink in over his head.

Extending for several miles out from the main shore was a seemingly endless area of floating tule islands, between which flowed a network of channels. The

A SEASCAPE ON THE CALIFORNIA COAST

A Gull is a master of the air. He can float on poised wings and at the same time reach forward with his foot and scratch his ear (see text, page 181).

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"GRANNY" BARN OWL

The eyes of the Owl are not in the side of the head, like those of the Sparrow, but in front, like the eyes of a man. An Owl has extraordinary organs of sight, for he can adjust them to see during the day or in the dark of the night.

tules had grown up for several generations. The heavy growth of each year shoots up through the dead stalks of the preceding season. On the top of this the Pelicans, Gulls, Cormorants, and Terns had perched and trodden down the tules. These precarious footholds were our only camping spots during the two weeks we cruised the Lower Klamath.

These days were full of hardship. The water of the lake contained so much sediment and alkali that it had to be boiled, while the only fuel we had was the little we carried in the boat.

The first morning out, we tried wetting down the tules and making a small fire on top. Before we could get anything cooked, the whole foundation was ablaze and coffee-pot and frying-pan had to be used to check the flames. After that we always sought a place where the tules could be cleared away and a fire made on the water-soaked roots even with the surface of the water.

"TWO'S COMPANY"

For ages the Owl was regarded by superstitious people as an ill-omened bird of prey. You may judge for yourself whether they are spooky or just spoony. These Barn Owls are the night police about the farm to keep mice and gophers in check.

The thick growth of tules made an excellent mattress. By spreading sleeping-bags on top of a high bunch and rolling in carefully, we generally had a good bed for the night. In the early part of the evening we were two or three feet above the surface, but by morning we had sunk down just about to water level.

The largest bird colonies of this region are located on the west side of the lake. In one place, for half a mile, the Western Grebes, White Pelicans, Farallone Cormorants, Great Blue Herons, California and Ring-billed Gulls, and Caspian Terns had combined, as it were, to form one of the most extensive bird colonies we had ever seen.

To the east of the Klamath lakes are other large alkaline bodies of water where water fowl abound—Summer, Abert, Goose, Warners, Harney, and Malheur lakes. In the spring of 1908 we started into the Malheur country, which is historic ground for a bird man. In the early seventies the well-known ornithologist, Captain Charles Bendire, was stationed at Camp Harney, on the southern slope of the Blue Mountains. He saw the wonderful sights of the nesting multitudes on Malheur and gave the first account of the bird life in that region.

On the south side of the lake, at the site of the historical old Sod House, a large spring rises at the base of the grav-

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THE CONDOR SMILE

The California Condor is a bird of slow growth; it takes more than six months to develop from egghood to full flight. This bird lived in the New York Zoölogical Park until 11 years old.

elly hill and winds out through the meadow land. For a mile it meanders along till it comes to the main part of the tule marsh—thousands of floating islands, between which flow narrow channels that are endless in their windings.

The main body of the lake is still a mile beyond the place where the spring branch enters the tule jungle. The tules grow 12 feet high; so that when one enters the mass he has no landmarks unless, perchance, he can read signs in the heavens.

We launched our flatboat in the spring branch and set out, anxious to get the lay of the land and see some of the birds. We passed from the spring branch into the serpentine meanderings among the tules.

LOST AMONG TULE ISLANDS

In one place I heard a pair of Sora Rails chattering anxiously. We shoved the nose of the boat into the tule mass that covered the water like an immense haycock. As I crawled out over the bow and stepped on the springy mass, the

footing seemed safe, for I did not sink in above my shoes. One needed a pair of snowshoes to walk on the surface.

By throwing myself forward and gathering under me an armful of buoyant tules, I made my way for 20 feet, with the excited pair of Rails leading me on. Suddenly I struck a weak place in the tule floor and I dropped into the muck beyond my middle. With the aid of an oar that was thrown to me, I struggled back to the boat.

We were now in danger of losing our way. A little farther on I left my handkerchief on top of a bunch of tules for a signpost. Still farther I stuck up a pole to mark our way back.

"We'll pick these up on our return," I said.

We swung around a tule island, working back in the direction from which we had come.

"I am beginning to lose my bearings," said my companion. I had already lost mine.

My first trip to Boston, that took me underground, overground, and up and down crooked streets, was as clear as wandering down a country lane in comparison to the embarrassment I felt when I tried to find my way in the narrow, walled-in, Venetian streets that circled these islands like a maze for about 10 miles east and west.

"The thing to do is to go back over the same track we came," I ventured. So we immediately turned about and spent the rest of the afternoon in trying to do it; but we never saw the handkerchief or the pole again.

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THE TUFTED PUFFIN, OR SEA PARROT

He has developed a powerful bill in feeding on shellfish. His face looks like the prow of a battleship. If you get too close, he will take your finger as quickly as he takes a fish (see text, page 181).

We had no food, nothing to drink but alkali water, and were wet, with no chance of getting dry; we *had* to find our way out. The sun was setting, so we knew east from west. We paddled as nearly as possible in the direction in which we had come. When at last we reached the end of a blind channel, where the tules seemed firmer, we decided to cut for shore by the shortest route. We floundered through the tules, sinking in the black muck of the marsh for some distance, and were suddenly confronted by a deep slough.

"Even the old tub of a boat looks better than this," said my companion.

MAKING FRIENDS WITH YOUNG BURROWING OWLS

These are most valuable birds in the farming districts of the West, because they catch great numbers of field mice, squirrels, and other small ground animals that do damage to crops. These three birds were taken out of a burrow and were soon on friendly terms.

We turned back again.

As the clumsy craft floated out into the channel and I sat straddling the bow, dangling my feet in the water to get rid of the mud, it seemed as if Nature had surely done her best to make the tule swamp unfit for man. The Rails ran lightly through the jungle, the Blue Herons stood fishing in the marginal water, the Red-wings and Tule Wrens clung to the swaying stems, the muskrats paddled homeward with tails waving contentedly to and fro; they all had places to sleep.

Darkness settled over the marsh. The stars glittered, the wind whispered in the tule tops, the birds were asleep.

It was almost noon the next day when by chance we struck the channel that led us out of the maze and back to camp. But we had learned the art of blazing a trail that we could follow through the tules, and after resting a day from our initial efforts we outfitted for a week's trip and set out down the spring branch. This time we kept a straight course to the north until we reached the main body of the lake.

Along the southeast side of the lake we discovered great colonies where White Pelicans, California and Ring-billed Gulls, Caspian Terns, and Great Blue Herons were nesting. Over on the north side were immense colonies of Western Grebes, Eared Grebes, Black-crowned Night Herons, and White-faced Glossy Ibis.

We were hunting mainly for colonies of American Egrets, or White Herons, which were formerly common on the lake. After a month's search we saw two flying over. They had been practically exterminated by plume-hunters.

Our expeditions into the Klamath and Malheur Lake countries were taken at the suggestion of Mr. William Dutcher, President of the National Association of Audubon Societies, partly with the idea of putting an end to the slaughter of wild birds in those sections, which were being killed to furnish plumes for the millinery markets. Upon our report of conditions, President Roosevelt issued a special proclamation on August 8, 1908, setting aside Lower Klamath Lake as a special reservation for the protection of

wild birds. A second proclamation was issued August 18, 1908, establishing Malheur Lake Reservation.

These two reservations are among the most important ever established, because of their wide marsh areas and the numbers of birds protected. Previous to this, October 14, 1907, President Roosevelt had created Three Arch Rocks Reservation, which was the first land set aside on the Pacific Coast solely for the protection of wild birds.

"A BIRD IN THE HAND"

A friendly Desert Sparrow at Tucson, Arizona. Birds are trustful if we are kind to them. They are wild because they have been persecuted so long.

HUNTING THE CALIFORNIA CONDOR

From a scientific standpoint, our photographic life history of the California Condor has been the rarest and most important work we have done. This was accomplished in 1906. After a long search, we found the home of the Condor in one of the mountain ranges of southern California.

The advance of civilization has all but led to the extinction of the species. If one were to start on a hunt for the California Condor, he might search for years, as we did, without success. In the whole world's collections, there are not a half dozen of these birds alive. In the various museums of the world one can find almost twice as many eggs of the Great Auk, a bird now extinct, as of this Condor. A few left in the wild state live almost entirely in the Coast mountains of southern California and a part of Lower California.

The report that the California Condor is rapidly following the Great Auk, the Labrador Duck, and other species, and that it will soon become extinct, is not without foundation. Its range is more restricted than that of any other bird of prey. In the early part of the last century it was reported fairly common as far north as the Columbia River region.

The main cause for the decrease in Condor numbers seems to be that when stock-raising became common in California, years ago, in order to secure pasturage during the dry months, the rangers were compelled to drive their herds back into the more remote mountainous parts. Here they invaded the retreats of panthers, grizzlies, and coyotes. These preyed upon calves and sheep. The quickest and best device for getting rid

A PET CALIFORNIA CONDOR

He was fond of playing in the sand by the river and sunning himself. He liked company and followed the camera man around like a household pet.

of these animals was by baiting the carcasses with poison. Since Condors came to feed on carcasses, many of these birds were killed in this way.

CONDORS RAISE ONLY ONE BIRD A YEAR

The Turkey Vulture has held its own in the struggle for existence against these forces, but the Condor is slow in recuperating its numbers. Even under favorable conditions, each pair of Condors will raise only one young bird a year. There is no existing authentic record of a California Condor laying more than a single egg at a sitting. One collector states that in a certain locality where a pair of these birds live, they have nested but three times in 12 years.

Under these conditions, it is not surprising that Condor numbers have decreased, and unless careful protection is given, the bird will soon follow the Great Auk.

The Condor egg which we found on March 10 was hatched on March 22.

During the months of April, May, June, and July we made frequent pilgrimages back over the rough mountain trails to this rocky shrine in order to study the home life of these birds and to watch the growth of the young Condor. On July 5, when the young Condor was about three and a half months old, he weighed 15 pounds. In order to complete our studies, we took the nestling to our Oregon home. It was not until the middle of August that he was well fledged, except that his breast was still covered with gray down. With his wings extended, he measured almost nine feet.

The slow growth of the Condor is shown by the fact that from the time the single egg is laid it takes a full six months or more for the parents to raise their offspring. In the case of a Sparrow or Robin, the time required for rearing a family is less than one month.

On September 28 the young Condor was sent to the New York Zoölogical Park, where he was well cared for and lived to the age of 11 years (see p. 194).

The Condor of the Andes has long been considered the largest bird that flies. It averages about 10 feet from tip to tip,

when the wings are spread, and weighs from 20 to 25 pounds. The California Condor will average the same.

The South American Condor is glossy black, with a broad white bar across each wing, and has a ruff of white down about the neck. The head is unfeathered and is covered with wrinkled red skin. The forehead has a cartilaginous comb or caruncle, and the throat is wattled like that of a common Turkey.

The California Condor is blackish in color, with the feathers of the back edged with brown. There is no caruncle on the head, but about the neck are loose black lancelinear feathers. The lining of the wings is white, and when the bird is soaring this mark distinguishes it from the Turkey Buzzard.

The size and strength of the Condor have often been exaggerated. There have been many absurd stories about these birds killing sheep and other animals. Dr. Alexander Taylor, who gave the best early account of the Condor, said that it had been known to kill and carry off a hare in its claws.

The habit of the Vulture is to wait till after death, and it is extremely doubtful that one of these birds would ever attack a living animal.

A DOWNY YOUNG TURKEY VULTURE

He has the reputation of being a lost soul in the bird world. He is a bird of prey, but, with a foot like a Chicken, he cannot clutch and hunt like a Hawk or Eagle. He does not hunt living things; he plays a waiting game.

THE BIGGEST BIRD THAT FLIES WAS "AS GENTLE AS A KITTEN"

As to the Condor's carrying its prey, this is easily discredited by a study of its foot. The claws are blunt and weak, and the foot is not adapted for grasping or carrying like that of an ordinary bird of prey.

In our study of the Condors at home, the most surprising thing to us was that this biggest of all birds, which has often been reported as wary and ferocious, was as gentle as a kitten. From such information as I had gathered about the California Condor, I should never have believed that we could get so close to this pair of big birds in the wild state. After our many visits, they had evidently got acquainted with us and knew that we would not harm them.

THE DINNER CALL IN THE RED-WINGED BLACKBIRD HOME

His black body and scarlet shoulder patches cause the Red-wing to be easily recognized about ponds and marshes of all parts of our country. He likes to tie his home in the reeds a foot or so above the water.

Both parents were very solicitous for the young bird in the cave. Several times, as we sat at the entrance very quietly, one of the parents, perhaps the mother, edged up within three feet.

The most surprising thing in all my bird experience was when the mother reached over and nibbled the sleeve of the camera man. Both old birds were near by. Occasionally they would caress each other.

To test the parents further, the camera man reached down into the cave, and when the young Condor began to hiss, the mother edged down and nipped the camera man gently on the gloved hand.

He loosed the glove slightly and she began tugging at it. He let the glove slip from his hand, and for a moment it hung in her bill; then she laid it at her feet.

HUNTING BIRDS IN THE ARIZONA DESERT

At first sight one might not select the desert as a retreat for a bird-lover. A friend who had lived in Arizona told us

there were no birds in the desert. She had been there two months and had scarcely seen a bird, she said. But perhaps she did not have an eye single to bird study. When one travels 2,000 miles to hunt birds with a camera, he is likely to find them, even in the desert.

One spring Mrs. Finley and I went to Arizona to study and photograph the birds of the desert. At Tucson we bought a horse and light buggy. For three months we wandered about day after day, through the cactus and along the old river bottoms, making friends with the birds.

The problems of the desert are intensely interesting to a naturalist. Take it from nearly every standpoint, Mother Nature is strict and harsh with all her children of the desert. Life is spent on the march or in the firing line. Nearly everything is fortified with thorns.

The cactus has a panoply of points to protect its soft, spongy meat; the mesquite, the paloverde, and the delicate white poppy clothe themselves in thorns.

The pudgy toad in our Oregon garden grows fat and lazy, but he wouldn't last long in Arizona. Out on the desert, Nature arms her "toads" and lizards in thorns and scales. The "toad" grows flat and thin, can run like a streak, and digs a hiding place in the sand. He wears a crown of thorns and is really a lizard instead of a toad.

Out in the desert we found birds in abundance: Road Runners, Verdins, Gnatcatchers, and three kinds of Thrashers—Palmer, Bendire, and Crissal. The river bottoms were always full of song, for there were numbers of Mocking Birds, Chats, Cardinals, Tanagers, Warblers, Towhees, Flycatchers, House Finches, and four varieties of Doves—Mourning, Inca, Mexican Ground, and White-winged.

THE AUTOMOBILE DEFEATS THE ROAD RUNNER

The Road Runner is, perhaps, the most striking character of the cactus belt. He has a variety of names—Ground Cuckoo, Mexican Paisano, Snake-killer, Chaparral Cock, and Cock-of-the-Desert.

When we first went to Arizona we were anxious to find a Road Runner. We found several old nests and occasionally we would catch a glimpse of a slim, long-tailed bird running through the cactus.

One day, when we least expected it, a Road Runner slid across the road, hopped up into a cholla cactus, and was instantly lost to sight in the thorny mass. We drove around the bush slowly, once, twice; closer and closer till we could see through the tangle. But no Road Runner! She had disappeared, and yet she could hardly have escaped without our seeing her. A slight movement in the cactus—there she was, sitting bolt upright, holding a lizard in her bill. Until she moved, she was as completely hidden as if she had not been there.

I have occasionally seen an old Road Runner that takes a delight in outdistancing a team of horses, but the bird is not accustomed to our modern method of traveling.

One day a friend was spinning down the Oracle Road in his automobile, when at the turn a Road Runner dropped into line ahead and set the pace down the smooth stretch. The driver turned on a little more gasoline. The bird looked over his tail at the horseless carriage. It was gaining on him.

As the machine bore down on the astonished bird, he became scared. He cocked his tail suddenly to put on the brake, made a sharp turn to the left, dodged into the cactus and creosote bush, and away he went, at top speed, as far as he could be seen.

While some people accuse the Road Runner of killing other birds, especially young Quail, our experience showed that he lived almost entirely on lizards. The young birds in the nest were fed on lizards from the time they were out of the egg. The reptile was always killed and thrust head down into the mouth of the youngster. The tail hung out of his mouth for a time, but as the head was digested the young bird gulped a little now and then, until finally the end of the tail disappeared (see pages 167, 186, and 187).

REMOVING THE COVERING FROM THE SLOPE OF SAN CUICUILCO

Photograph by Byron Cummings

The excavations conducted by Dr. Manuel Gamio, director of anthropology in the Bureau of Agriculture and Public Works of Mexico, and Prof. Byron Cummings have proved thus far that San Cuicuilco is an artificial mound covered by the accumulations of ages. Its original structure was a truncated cone 412 feet in diameter and 52 feet in height (see text, page 209).

RUINS OF CUICUILCO MAY REVOLUTIONIZE OUR HISTORY OF ANCIENT AMERICA

Lofty Mound Sealed and Preserved by Great Lava Flow for Perhaps Seventy Centuries is Now Being Excavated in Mexico

By Byron Cummings

Professor of Archeology, University of Arizona

ABOUT 1,000 years before Pharaoh was driving his slaves to the construction of the Great Pyramid of Egypt, and some 5,000 years before the Assyrians were mixing their sweat with the mortar that held the bricks of the great palace of Sennacherib together, some ancient Indian chief of the Valley of Mexico was forcing his subjects and slaves to rear a mighty structure on which to honor the gods of his land.

The inhabitants of the Mesopotamian plains raised lofty platforms and extensive palaces to honor the living rulers of their domain; the people of the Valley of the Nile built massive pyramids to serve as tombs for their political and religious masters; but in Mexico the multitude toiled and slaved to build great pyramids on commanding sites which might serve as temples to their gods.

A VALLEY BAPTIZED WITH FIRE

The Valley of Mexico seems guarded from outside intrusion by a ridge of mountains along which rises many a rounded crater that speaks forcefully of the repeated baptisms of fire which Mother Earth has poured out upon this choice spot.

While the destruction wrought by these visitations of wrath of the fire god has evidently been terrific, yet the earth thus enriched became a veritable treasure-house, which needed only to be touched to yield vast stores for the delight of man.

Here has been a Garden of Eden, where the gods loved to linger and experiment with various stocks and successive generations of men.

Just west of the pass that leads from the Valley of Mexico over into the Valley of Cuernavaca, rises the irregular crest of old Ajusco, from whose lofty craters have poured many showers of ashes and pumice and many streams of lava to envelop the plains below (see map, page 207).

The most recent of these craters is a huge bowl, some 1,500 feet in diameter and 300 feet deep, rising from the northern slope of the Ajusco group, about 10 miles south of Tlalpam. The round wooded crest of this crater, called Xitli, forms a striking landmark above and to the right of the railroad as one climbs toward the crest of the pass in going from Mexico City to Cuernavaca.

Over the rim of this great bowl poured a stream of black lava that flowed down the northern slope of the mountain and out into the fertile valley below.

Its seething current swept on like some mighty fire-breathing dragon, carrying death and destruction to all living things in its path.

This stream flowed past Zacatepec, one of the hills reared by some former eruption of the higher craters of Ajusco, to the borders of San Angel on the north and to the outskirts of Tlalpam on the east.

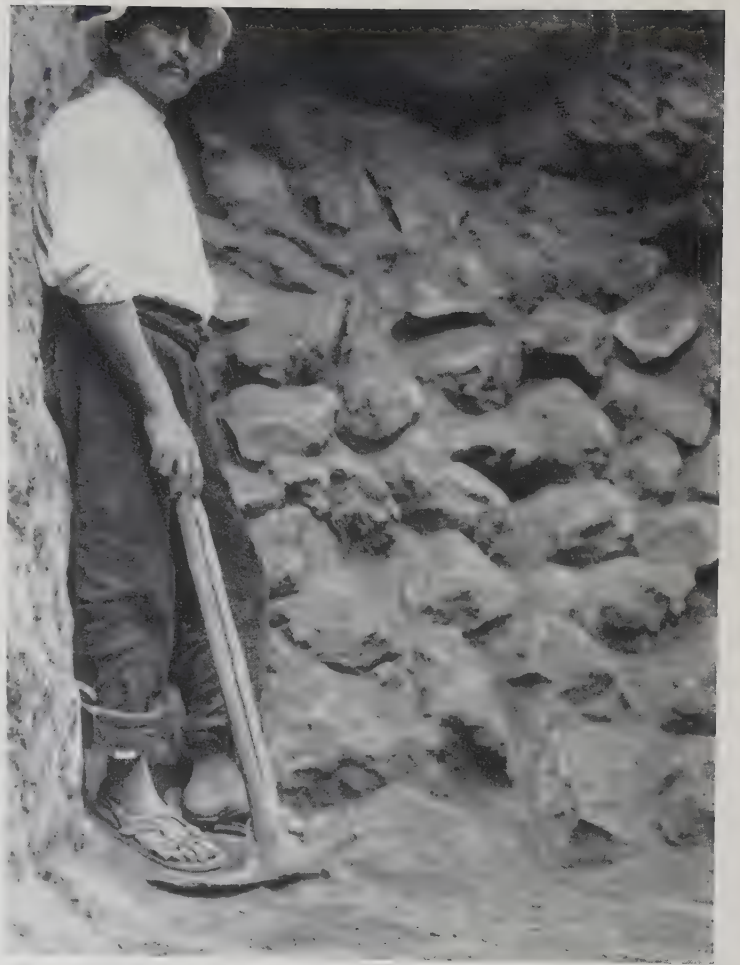
As it slowly swept on toward the northeast, it crept entirely around and tried to climb the slopes of a low hill which the natives to-day call San Cuicuilco.

LAVA FLOW MAY HAVE OCCURRED 7,000 YEARS AGO

This great tongue of black, flinty lava, called the Pedregal (meaning "Stony Place"), some 15 miles long and 3 miles wide, varies in depth from 5 to 30 feet. Its surface is wrinkled and twisted and seamed by many a deep crack, broken gorge, and yawning cistern. Its hard, rough surface grins defiance at the ages, and the trails across its expanse, used by

Photograph by Byron Cummings

THE SOUTHEASTERN SIDE OF CUICUILCO, SHOWING THE SLOPE ABOVE THE PEDREGAL LAVA AND THE SUSTAINING WALL, BUILT AFTER THE STRUCTURE HAD BEEN COVERED WITH 18½ FEET OF VOLCANIC SAND



THE FIRST PIECE OF WALL UNCOVERED AT CUICUILCO UNDERNEATH THE VOLCANIC DEPOSITS

SHOWING THE DEPTH OF THE VOLCANIC DEPOSIT COVERING THE TOP AND UPPER TERRACE

Photographs by Byron Cummings

Photograph by Byron Cummings

UNCOVERING THE BASE OF THE MOUND WHICH LIES 25 FEET BELOW THE LAVA OF THE PEDREGAL

Geologists' estimates of the date of the lava flow at Cuicuilco vary from 5,000 years before the Christian Era to about 2,000 years ago. The artificial mound was probably ancient when the volcanic eruption occurred.

the natives for centuries, show very little wear.

Geologists have traveled around the Pedregal and stumbled across its sharp, craggy surface; have studied its flora and the weathering of its watercourses and arrived at widely different conclusions as to the time when the lava flow occurred.

The latest authority to put himself on record in an estimate of its position in our chronology is Mr George E. Hyde, a geologist from New Zealand, who spent the winter of 1921-22 in a study of the Valley of Mexico for the Mexican Government.

Mr. Hyde declares that the Pedregal must have been deposited at least 7,000 years ago, or some 5,000 years B. C. The latest period assigned to it is some 2,000 years ago, or about the beginning of the Christian Era.

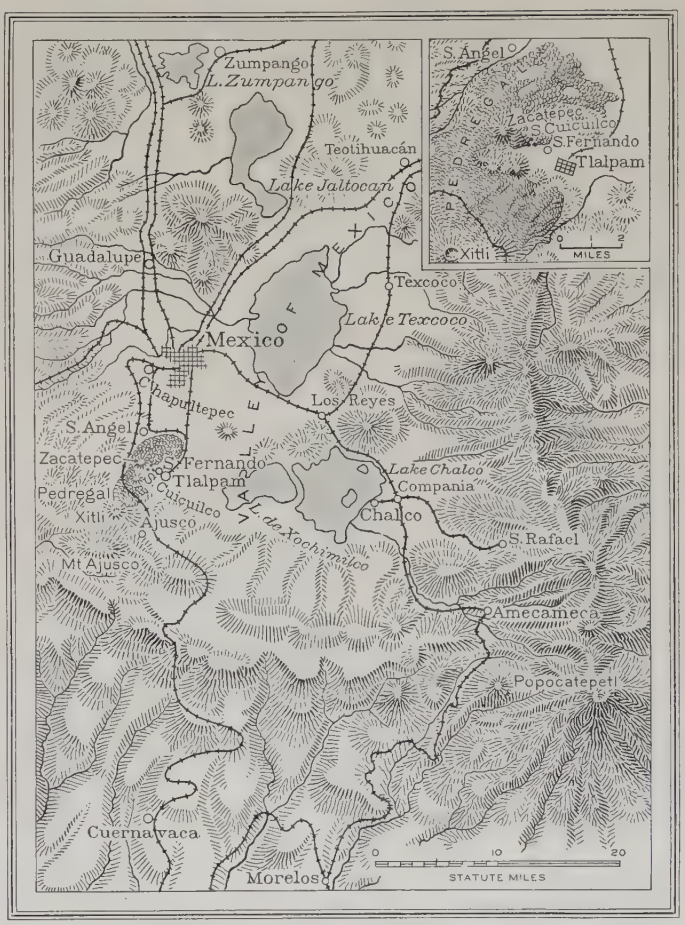
Since no tradition regarding the eruption of Xitli seems to have survived among the Aztecs or other Indians of the region, and since the external evidences of the Pedregal itself indicate a long

period of weathering, is it not quite as reasonable to assign the earlier date to a catastrophe fraught with such terrible consequences that its memory would have survived through many, many generations of men?

It is evident that before the eruption of Xitli a numerous population occupied this part of the valley, and if the cap of lava, known as the Pedregal, could be removed the ruins of houses and villages would be disclosed.*

The hill of San Cuicuilco, which we have already mentioned as surrounded by this lava flow, is situated near the village of San Fernando, a part of Tlalpam, which is a thriving town situated about 12 miles south of Mexico City at the northern base of Mount Ajusco.

Dr. Manuel Gamio, director of anthropology in the Bureau of Agriculture and Public Works of Mexico, had noticed this lava-surrounded hill and invited the writer to examine it with him. The result of the visit was a plan for the investigation and excavation of the mound.



Drawn by A. H. Bumstead

A SKETCH MAP SHOWING THE LOCATION OF CUICUILCO AND THE PEDREGAL LAVA FLOW WHICH HAS PRESERVED THE ANCIENT MOUND

The Government of Mexico, through Dr. Gamio's department, agreed to furnish the men and materials necessary for the work, and the writer took charge of the excavations and the collection of data.†

A few days after we began operations, some of the workmen declared that at 6 o'clock on the 4th of May a light danced above the top of San Cuicuilco and then passed slowly across the Pedregal to the crest of Zacatepec, another hill lying to the west. This was accepted by the

*At San Angel the Mexican Government has carried on extensive investigations beneath the lava of the Pedregal. Numerous tunnels have brought to light several skeletons, many pieces of pottery, and many stone implements. The artifacts disclose a culture that the Mexican archeologists class as archaic and which, according to universal classification, belongs to the early neolithic culture of the Stone Age. At other points on the edge of the Pedregal similar articles of human workmanship have been encountered.

† The Mexican Government extended every courtesy during the work of excavation and fulfilled all its promises. It speaks eloquently for the farsighted and enlightened interest of the present administration in Mexico that it is willing to provide from its limited revenues for carrying forward scientific investigation.

The writer had intelligent and happy cooperation from Dr. Gamio and his department, and hopes that the years to come may see a greater sympathy, a better understanding, and a larger coöperation established between the people of Mexico and those of the United States, especially among the scholars of the two countries.—B. C.

Photograph by Byron Cummings

TRENCHING TO DISCOVER THE BASE OF CUICUILCO

When the work of excavation began, the rumor spread that the investigators were seeking treasure buried either by the Aztecs or by the Spaniards, and often outsiders stole into the workings and tried to excavate also.

laborers as evidence that there was treasure in both hills, and from that time on many were the stories circulated of treasure buried in the hill by Aztecs and Spaniards.

The Spaniards and mestizos especially watched our operations with eagle eye and constant attention. At times, as we reached places that seemed to them particularly favorable, they stole into our workings and tried to excavate.

Some declared that an ancient chief had been driven to the Pedregal by the Aztecs and had gathered his followers about him and prospered in spite of the inhospitable surroundings. There he was buried with great treasure and this mound raised over him. Others vowed that the Spaniards, at times of civil strife, before a stable government was established, hid treasure in San Cuicuilco that had never been recovered.

This lava-covered plain has ever been a place of refuge for criminals, revolutionists, and those out of harmony with the dominant political party. Many a man can point out the caverns that sheltered him and perhaps his whole family for weeks and months. Even now the people living near it seldom venture out alone after nightfall.

But, as the work progressed, most of the people came to realize the truth of our statements: that the builders of Cuicuilco had neither gold nor silver and were

blessed with very little else that could be counted valuable to-day.

A GIGANTIC ARTIFICIAL MOUND RAISED BY ANCIENT AMERICANS

San Cuicuilco has more than fulfilled expectations. It has proved to be an artificial mound covered by the long accumulation of ages. Its original structure was a truncated cone 412 feet in diameter and 52 feet in height. The rounded shape of the pile is in keeping with the circular form of all the most primitive homes.

The top forms a broad platform 290 feet in diameter, probably a place for ceremonial dances. The name Cuicuilco, an Indian word handed down from the past, suggests singing and dancing, the two great essentials of religious ceremonies for primitive Americans.

This structure consists of an outer wall of rock 70 feet thick at the top with a central core of filled earth. This thick wall is composed of chunks and shells of lava compactly piled.

The outer surface inclines at an average angle of 45 degrees and consists of large unhewn blocks of lava, many three and four feet in length, with the smaller end pointing toward the center at right angles to the surface and bedded in smaller lava shells.

The style of the surface masonry is crude cyclopean, and very little attempt was made to present a flat surface of the boulder to the outside. Holes were filled with smaller stone or, where the rocks seemed sufficiently solid, were left open. No other filling material of any kind was used.

No attempt had been made to chip the rough blocks to make them fit better or provide smoother exterior surfaces. The inclination of the surface and the weight of the dense chunks of basalt and andesite have kept the wall intact and only small portions of the edges had been shaken from their positions before the structure was covered.

The base of the cone lies 25 feet below the present surface of the surrounding terrain and the top platform is covered by 18 feet of volcanic material.

On the terraces, and still clinging to the slopes in many places, is encountered similar volcanic material. Over this is a covering of vegetable loam and clay that

AN ALMOND-EYED MAIDEN FROM CUICUILCO

Photographs by Byron Cummings

TYPE OF POTTERY RECOVERED FROM BENEATH THE CUICUILCO LAVA

This piece of earthenware had been buried for probably more than 7,000 years.

Photograph by Byron Cummings

EMBLEMS OF THE FIRE GOD DISCOVERED BENEATH THE LAVA

Photograph from Byron Cummings

THE AUTHOR EXAMINING THE GOD OF FIRE, FOUND AT CUICUILCO

These clay figurines and idols show the beginning of the mastery of materials and the coming of trained hands, eyes, and intellects (see text, page 213).

Photograph by Byron Cummings

AN ANCIENT INHABITANT OF CUICUILCO

His remains had lain for probably more than 7,000 years beneath the lava flow.

the recurring rainy and dry seasons of the centuries have accumulated.

Large time-honored pepper trees flourish on the summit or strike their roots deep into the sustaining walls that some later generations of men have built along the slopes.

In these walls and in a large pile of rock and earth found on the southwestern side of the platform appear many waterworn boulders that must have come from the bed of some river now lying beneath the Pedregal lava.

LAVA BOULDERS USED IN BUILDING MOUND ANTEDATED PEDREGAL LAVA

In the center of the top platform and beneath eight feet of volcanic material and surface loam stands a crude altar of waterworn boulders and clay. It is 22 feet long and 9 feet wide. The corners are rounded and the eastern half is a platform raised two feet above the floor of the western half and surrounded by a wall that raises its outer edge one foot higher. This portion is in the form of a horseshoe with its open end pointing a trifle south of west (see page 215).

The whole rests upon a platform of large lava boulders bedded in sand and clay. This platform in turn rests upon a hard clay floor that has been beaten down, smoothed, and polished by the tread of many generations of men.

The rock and clay platform has a diameter of 55 feet, but the extent of the clay floor beneath has not yet been determined. Beneath this clay pavement are two others, the lowest at the level of the original platform of the truncated cone.

The lava rock found in every part of the structure—in the more recent as well as in the most ancient—is of a flow that antedates that of the Pedregal, which, as stated on page 206, occurred many thousands of years ago. Not a piece of the Pedregal lava has been found in any of the walls or even in the pile of earth and rock encountered on the top.

Lying scattered about its base are chunks and shells of lava of a type similar to that found in the structure. They seem to have rolled down the slopes from the edges of the walls above and accumulated in a great mass at the bottom. Above these lie from 12 to 15 feet of volcanic

Photograph by Byron Cummings

A CRUDE HUMAN FACE PECKED ON THE SURFACE OF A HARD BOULDER, FOUND AT CUICUILCO

material similar to that covering the top platform and the terraces.

This accumulation is thickest at the base and diminishes in depth as it extends up the sloping walls to the first terrace. Above this is a mass of clayey loam filled with lava boulders that have rolled down from the broken terrace walls of the later construction.

MOUND SEALED AND PRESERVED THROUGH COUNTLESS CENTURIES BY LAVA

At the bottom of this accumulation of surface loam and rock is a stratum, varying in depth from 5 to 18 inches, of charred and blackened material, the product of severe heat. Under the lava it is a crisp mass, with here and there a pocket of black sand or ashes.

On every side are encountered the black, forbidding faces of the Pedregal, which pressed their numerous noses against the covering of old Cuicuilco until they were flattened and rounded and buried deep in its yielding soil. In some places, where the more gentle slope of the covering permitted, the many-headed lava monster climbed up the slope, burying the base far beneath and holding the great temple in its ironlike embrace.

From the eastern side a great platform 30 feet long and 70 feet wide extended down on an incline from the first terrace. Most of its walls had fallen and been buried beneath wind-swept dust and ashes before the Pedregal lava crept up over them to a distance of 10 feet.

These 15 to 17 feet of sand, clay, and rock that had accumulated above the surrounding pavement of Cuicuilco before the lava flow occurred, demonstrate that *its builders had lived and worked thousands of years before the Pedregal had formed.*

It is reasonable, then, to assume that this temple was reared by primitive Americans who lived some 8,000 or more years ago.

Thus the forces beneath old Ajusco volcano have been laboring for ages effectively to seal up and preserve this handiwork of ancient Americans.

EXCAVATIONS MAY REVOLUTIONIZE OUR CONCEPTION OF ANCIENT AMERICA

Time is a wonderful leveler and Nature is also ofttimes a remarkable preserver, saving the records of the world's progress that men may be stimulated to deeper investigation of her forces and of the part man has played in the understanding and mastery of those forces and the materials they produce.

Cuicuilco presents to us to-day positively and forcefully a chapter of human history on the American Continent that many have supposed never existed. Its rough, massive walls and simple outlines show the beginning of public architecture in North America. Its extensive proportions and great mass of material are evidences of early political and social organization, and demonstrate the won-

Photograph by Byron Cummings

UNCOVERING THE SLOPE

derful results of human coöperation in primitive society.

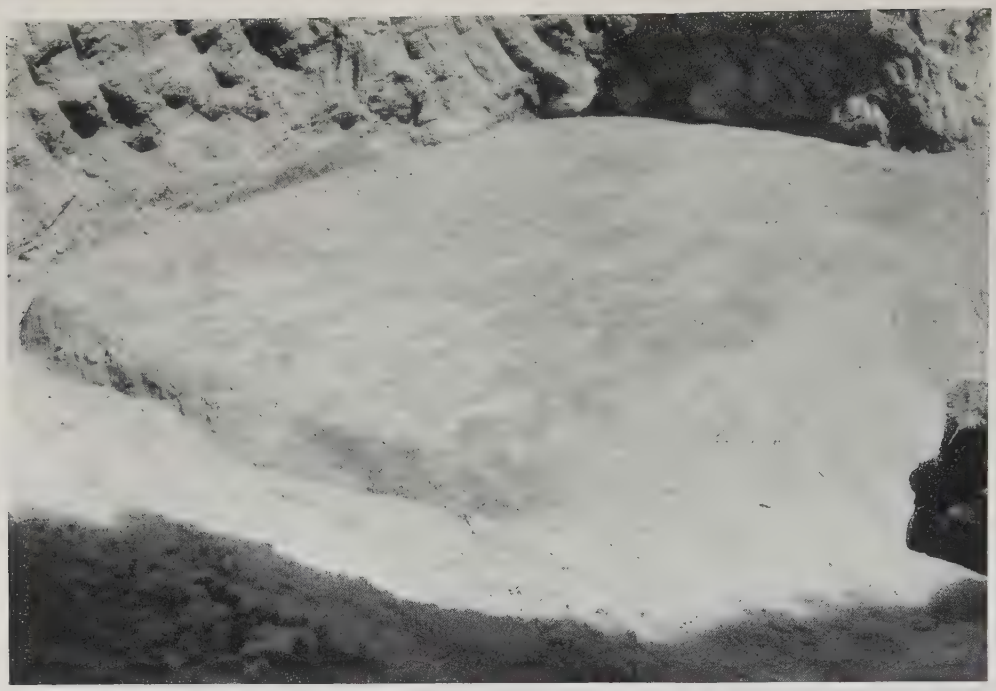
Its chipped or roughly ground stone implements, its crude pottery with an occasional attempt at decoration by incised lines and dots or awkwardly molded relief, its childlike attempt to represent the human form in clay figurines and idols, all show the beginning of the mastery of materials and the coming of trained hands, eyes, and intellects.

Cuicuilco is not spectacular. It does not astonish us with its beautifully hewn masonry or its skillfully carved façades and painted friezes. Its architecture was massive and simple, dedicated to the mighty forces of earth and air. Its decorations were meager and crude. Man had not yet reached that stage in which his imagination ran riot and controlled his activities, and his hand had not yet acquired sufficient skill and mastery to interpret his aspirations to his fellow men. Ages had to pass as man slowly groped his way toward a realm of broader understanding of himself and his universe and toward a more varied and more real expression of what he felt and what he saw about him.

CUICUILCO THE FORERUNNER OF ORNATE AMERICAN ARCHITECTURE

Cuicuilco represents the results of stolid, vigorous Youth, Youth just beginning to feel his strength and daring occasionally to straighten up and ask the spirits to teach him.

This edifice is the foundation upon which was built that massive and ornate American architecture whose ruins dot nearly every height, plain, and valley from Zacatecas to Panama and from Guerrero to Yucatan. Its walls are rough and massive, yet preserve a beauty of line



A CLAY PLATFORM PAINTED RED FOUND BENEATH THE ROCK PLATFORM IN THE CENTER OF THE TOP OF THE CUICUILCO STRUCTURE. THIS MAY HAVE BEEN AN ALTAR

Photographs by Byron Cummings

UNCOVERING THE EASTERN SLOPE OF CUICUILCO

Photograph by Byron Cummings

THE HORSESHOE ALTAR

This photograph was taken from the top of Cuicuilco, looking south toward Xitli, the crater from which came the Pedregal lava flow (see text, page 203).

that undoubtedly inspired the descendants of its builders to create the mighty pyramids, the wide paved plazas, the beautifully decorated halls of Teotihuacán (see illustration, page 216).

The Pyramid of the Sun, the Ciudadela, and the ornate Temple of Quetzalcóatl, as shown in the illustration on page 218, all speak forcefully of the wonderful organization of the Toltecs and the great skill their artisans had acquired. As in the ancient lands bordering on the Mediterranean, one can trace the development of the builders' and decorators' art from the crude cyclopean masonry of Tiryns to the beautiful Temple of Athena on the Acropolis at Athens, so, just as truly, can one follow the course of the development of ancient American architecture and architectural decoration in the Valley of Mexico.

Here was a land of human achievement that left a record extending far back into the dim beginnings of man's attempts to understand himself and to establish the proper relations with the forces operating about him. Does this American record of human endeavor suffer by comparison with that of ancient Egypt or far-famed Greece?

HUMAN HISTORY IN AMERICA BEGAN MILLENNIUMS BEFORE BIRTH OF CHRIST

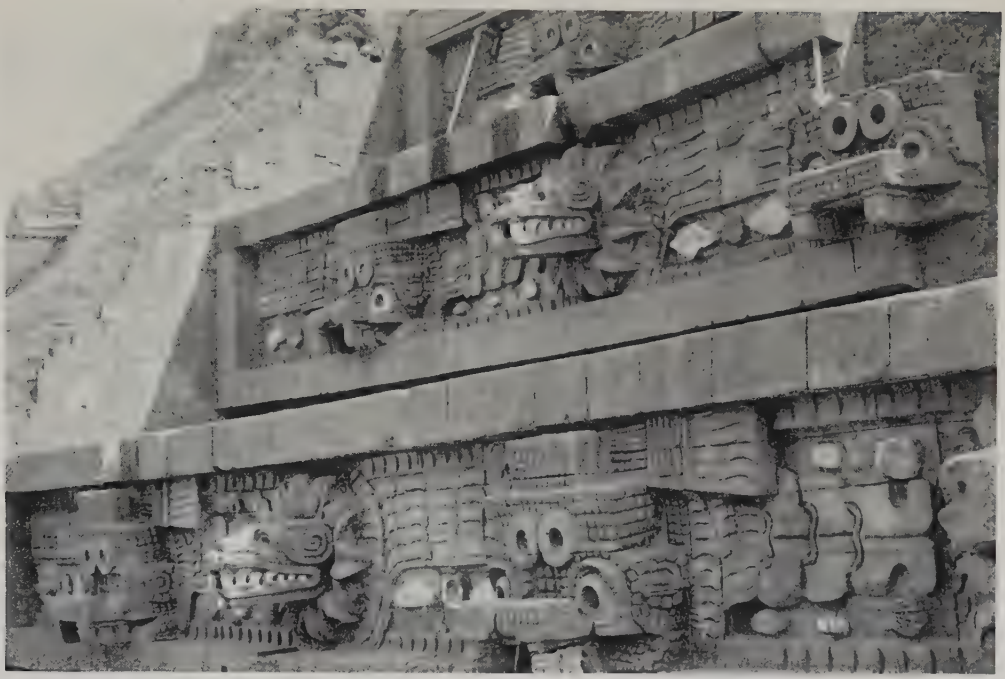
The indications deduced from the investigation of the various American Indian languages and the facts presented by old Cuicuilco agree that human history in North America began thousands of years before the Christian Era.

Wherever the first ancestors of the native American may have arisen, it is certain that that same native American had populated extensively certain portions of our continent when he had attained only

Photograph by L. H. MacDaniels

ONE OF THE TEMPLE STAIRS AT TEOTIHUACÁN

The pyramids at this ancient Toltec city, which is within an hour's ride by rail from Mexico City, were built of adobe bricks, faced with stone and cement, and apparently were enlarged from time to time. On the top of each there was probably an altar dedicated to its particular god.



Photograph from Mrs. O. R. de Lozano

THE TEMPLE OF QUETZALCÓATL, OR THE "FEATHERED SNAKE"

Photograph by Clifton Adams

A DETAIL OF TOLTEC DECORATIVE SCULPTURE

One of the great stone snake heads that adorn the outer surface of one of the smaller and more ancient pyramids found inside the newly excavated citadel discovered near Teotihuacán.

Photograph from Mrs. O. R. de Lozano

THE LOFTY PYRAMID OF THE SUN AND THE PYRAMID OF THE MOON (MIDDLE BACKGROUND) AS SEEN FROM THE TEMPLE OF QUETZALCÓATL (IN THE FOREGROUND)

The Pyramid of the Sun and the ornate Temple of Quetzalcóatl speak forcefully of the wonderful organization of the Toltecs and the great skill their artisans acquired. It is believed that the rough and massive edifice at Cuicuilco inspired the descendants of its builders to create the mighty pyramids shown above (see text, page 215).

the crude rudiments of human culture, and when other members of the human family were struggling with like problems and fighting their way toward the light in other parts of the world.

The steps of human development from the simplest beginnings are as easily traceable in the Valley of Mexico as in Mesopotamia or the Valley of the Nile. Rudely chipped stone arrow and spear points and knives give way to finely chipped points and flaked blades of rare workmanship. Beautifully fashioned and polished stone hatchets and battle-axes are finally replaced by those of copper.

The progress of ornaments for the person can be traced from the crude clay and stone ear and lip pendants to elaborate jewels wrought in gold and engraved stones.

Domestic utensils manifest all stages of skill and adaptation, from the hammer stones and the grinding stones selected from the natural waterworn boulders of the river beds and lake shore, to the bowls, pitchers, and ollas beautifully fashioned of clay and burned, polished, and decorated with skill.

The development of the weaver's art is shown from rude baskets and coarse cloth to garments and mantles finely embroidered in a great variety of materials, designs, and colors.

A DISTINCT TYPE OF MAN DEVELOPED IN AMERICA

Sculpture is encountered everywhere, from the crudest of stone images to life-size and colossal representations of men, intricate geometrical designs, and elaborate symbols.

Thus, in every class of material known and used by prehistoric people, one can trace step by step the understanding and the mastery man gradually gained over his environment.

This knowledge of design and color combination, this mastery of form and proportion in a great variety of substances, and the ability to marshal men and materials in the construction of beautiful palaces and great temples, are results obtained by a people after generations and generations of practical experience.

In all is seen a distinct American type. The physiognomy of the skeletal remains, the architecture, the industrial and decorative arts, all show an American development.

Point out as we may similarities to Mongolian types, or to western Asiatic and Egyptian designs and conceptions, we must acknowledge after all that the early inhabitants of America were distinctly American. Their dissimilarities to Asiatics, both east and west, to Africans, and to Europeans are far more pronounced than their similarities. They form a large group of the human family, separated from the parent stock in some remote age, who, as they gradually multiplied and possessed themselves of this part of the globe, sought to surmount its obstacles and to become masters of their surroundings.

Is it strange that these people, engaged like those on the other side of this sphere in a struggle under similar climatic and geographic conditions, should develop some similar religious concepts, social customs, and artistic standards and designs?

The early American did not differ greatly from the early Asiatic, the early Egyptian, or even the primitive European. He offered such incense to his own gods as he thought best won their favor and coöperation, and tended his own garden and managed his own household in his own peculiar fashion; but he evolved many ideas, characteristics, and customs akin to those of his cousins across the seas. And is not this as we should expect?

Everything he touched, as shown in his architecture and his art, bears the stamp of his individuality and the influence of the natural phenomena of the Western World; and yet, at the same time, his works express the aspirations of the whole human race in its attempt to solve the mysteries of the universe and to understand its own relationship to its phenomena.

A FIELD FOR FURTHER RESEARCH

America thus has a prehistory extending far back into the early centuries of human development. The steps of her progress and the successes achieved are as interesting and instructive as any attained by the renowned human groups of the Old World.

Had the Spanish governors who were in control of Mexico in the first years

Photograph by Byron Cummings

THE EASTERN SIDE OF THE CUICUILCO MOUND, UNCOVERED TO THE LEVEL OF THE SURROUNDING LAVA, SHOWING TOPS OF WALLS OF TWO ENLARGEMENTS OF THE ORIGINAL STRUCTURE

The crude masonry of Cuicuilco is not so spectacular as the wonderful structures at Teotihuacán (pages 216-218), but it convinces us that native engineers built colossal monuments in very early times in Mexico. The fact that the pyramid at Cuicuilco had fallen into disuse, and that a considerable accumulation of earthy débris had gathered upon its slopes before the Pedregal lava flowed across the valley and partially covered this débris, adds greatly to our speculative and scientific interest in the ruin.

after the conquest been men of broader caliber and truer vision, the task of assembling the record of these glorious and heroic periods of human history in America would be comparatively simple.

The people themselves had done their duty and made permanent records of the ideals and achievements of the various nations. Some scholarly and honest priests and monks carefully studied and translated many of these records, but intolerance and ignorance consigned nearly all the manuscripts to the flames and sent their authors back to Europe.

However, the task, though thus made more difficult, is ours. The unraveling of the history of early America devolves upon American scholars from Canada to Chile, and it is hoped that the brains and energy necessary to carry the task to a successful conclusion will soon be forthcoming.

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THE COASTS OF CORSICA

Impressions of a Winter's Stay in the Island Birthplace of Napoleon

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IF CORSICA were a woman instead of an island, she would suffer many temptations, for she is very beautiful and very poor. Her perfumed mantle of maquis is rent here and there, revealing the beauty of her rounded form. The delightful odor that Napoleon remembered in his dreams is as subtle as it is insistent.

Submerged by wave after wave of history and conquest, home of a race full of passion but free from low crime, the scented isle south of the Côte d'Azur offers a distinctive reward to those who leave the rush and display of the Continent to visit vendettaland.

Corsica, like every other country, is a land of contrasts. But, more than most, it is the land of paradox. Behind the striking beauty of the island, concealed beneath the commonplace exteriors of the people, there is a mystery, a contrary quality which first escapes observation and later intrudes everywhere. Probably nowhere is a generalization more likely to be true and false at the same time.

One goes to Corsica, as did Boswell's friend, expecting to find every bandit a menace. He remains to find the man with the gun the most unromantic of mortals. Melodrama heroes have accomplished more with the glitter of a silver spoon held revolverwise than the most Tartarinesque of Corsicans attempt when loaded to the belt. Yet personal encounter between natives is still a commonplace.

Corsica, where women go safely alone by night and gendarmes travel in pairs by day, where there are hundreds of bridges and no rivers, where every one expects the visitor to pay verbal tribute to "Kalliste" (Most Beautiful) and few can name the mountains in whose shadow they were born!

Banditry is still a byword and thievery is abhorred. The innkeepers boast of what grand things they would do if there were more tourists, and neglect the few they have. The sun gives the land its charm; and the snow, its beauty and health. The roads are blocked by horses, mules, and donkeys, few of them laden, and the automobile, even for the single traveler, offers the cheapest means of transportation. The perfume of the maquis and the smells of the streets are alike indescribable.

Animals, made roommates, are treated cruelly, and children, seldom at home, are generally allowed to do as they please.

Life is somber and death is still the supreme event to those whose monotonous days are as tenaciously clung to as in happier and less lovely lands.

Photograph by Clifton Adams

AT THE PUBLIC LAUNDRY OF AJACCIO

Had she lived a century and a half ago she, too, might have been a Mme. Sans Gêne and credited the future Emperor for the price of his week's washing.

The mountain sides are terraced with infinite labor and the most fertile plains are left untilled. The sea is all around and mariners are few. Bad sailors that they are, the Corsicans claim kinship with Columbus, and, indomitable fighters, they ignore Napoleon. Sacred personages, pictured on many walls, are profaned on most male lips.

The donkeys and pigs feed on chestnuts of such quality that few in richer lands could afford, and every third child seems underfed.

But as one looks back on Corsica from the confetti-strewn Corso in Nice, he longs for the simple, unspoiled, paradoxical paradise to the south, so comfortless, yet so compelling in its charm. With however little earnestness life in Corsica seems to be conducted, it is real. In Nice, life is acted; in Corsica it is lived—and lost.

Drawn by A. H. Bumstead

A SKETCH MAP SHOWING THE GEOGRAPHICAL RELATION OF CORSICA TO THE MOTHER COUNTRY, FRANCE

SETTING SAIL FROM MARSEILLE AT TWILIGHT

We sail at twilight from Marseille, with the shadow of the great cathedral on the busy port and the bibulous sun departing in a ruddy glow and turning over the responsibilities of the harbor to the blinking lighthouses.

The propeller takes hold, and we edge our way out of the Bassin de la Joliette, Corsica-bound.

The domes of the Byzantine cathedral melt into the dark dome of the sky. The Transporter Bridge, weblike in the haze, saws its way across the seemingly tiny form of Notre Dame de la Garde, high on her barren hill. Beyond the battlements of Fort St. Jean the entrance of the Old Port yawns and then closes behind the School of Medicine.

On our right, black islands loom larger and larger. Against the henna sky, the light near the Château d'If flashes its signals. Marseille is now a formless mass, touched here and there with spirit flames until there comes a dull glow like a distant forest fire. A three-master slides across the moon.

We begin to dip to the waves, whose sound rises and dies away beneath our prow. To our left is the glittering necklace of lights that stretches along the Corniche Road to the place where Mont Rose closes the long beach as Diamond Head puts a period to the similar curve at Waikiki.

The steamer is built for freight, with passengers mere impedimenta to be tolerated. Our cabin, a bare, cheerless dungeon shared by three, is below the water line. The food is fair, the bedding clean. What more can one ask of a vessel which will bring one at sunrise to the Gulf of Ajaccio, with the Îles Sanguinaires—with British readers one dare not call them the Bloody Islands—standing guard on the left and a great line of mountains, from the side of which the old monastery of Chiavari enjoys a matchless view, bathing their feet in the blue to the south and east?

FORTY THOUSAND CORSICANS DIED FOR FRANCE IN THE WORLD WAR

The Gulf of Ajaccio lays its spell upon the traveler. One almost looks for the smoking cone of Vesuvius, for he knows that these same waters have played hide and seek in the Blue Grotto of Capri.

The comfortable hotel stands in a huge garden, nicely tamed in front, but savage with cactus, aloes, and maquis behind. The directress throws wide the windows to the balmy air and asks:

"Is it not a lovely climate that we have in Ajaccio?"

Oranges hung heavy on the trees beneath my window. The roses had begun

Drawn by A. H. Bumstead

A MAP OF THE ISLAND OF CORSICA

This Mediterranean possession of France has an area about equal to that of Porto Rico, but with less than one-fourth the population.

Photograph by Clifton Adams

THE STARTING POINT FOR A TRIP TO CORSICA—MARSEILLE

This crowded Vieux Port was the original port of the city. The modern church of Notre Dame de la Garde, overlooking the city from the heights, is beloved by seafaring men.

to drop their petals before the rigors of December.

In postwar Europe the interest in Corsica is almost unique. Life has undergone comparatively slight changes. No new boundary touches the people, nor any change of governmental control or nationality. Corsican mountain lads fought splendidly on the fields of France and 40,000 of them, out of a population of less than 300,000, gave their lives for "la belle patrie"; but no treaty resulting from the war affected the inner life of the Corsican people. An excess-profits tax is unknown to the thousands who, always living with a minimum of effort, have never known what capital and surplus are.

The movement toward the cities, so striking elsewhere, has affected Corsica little. The largest of its industries hires but a handful of men. Beyond the coasts there are only three towns that have a population of more than 3,000, and the thousand or so inhabitants credited by the census to a single village are really divided among several hamlets, included under one name but scattered about the hillside in a fashion which reveals separatist tendencies even in town affairs.

By following the coast we shall see most of the larger villages of the island and by so much lose sight of the true Corsican, who looks down in a real as well as a figurative sense on those who live in what to him are crowded cities.

CORSICA LACKS THE COLOR OF SARDINIA

Nowhere has Nature so queened it over her subjects. The people add nothing to the scene. Certainly they do not give it its interest. From the attractive widow's weeds of the Cours Napoléon or the Place St. Nicolas to the somber costume with green-black headshawl which frames the sallow, wrinkled faces of the old women of the interior, costume never flares forth with lambent color as it does in Sardinia,*

*See "The Island of Sardinia and Its People," by Guido Costa, in the NATIONAL GEOGRAPHIC MAGAZINE for January, 1923.

Photograph by Maynard Owen Williams

WHERE A WOMAN SAVED NAPOLEON FROM DEATH

The commemorative tablet on the wall reads: "Before this cathedral, on the evening of Easter Monday, April 8, 1792, in the course of the bloody disorders between the Ajacciens and the National Guard, Napoleon Bonaparte, Lieutenant-Colonel, Second in Command of the Second Battalion of the National Guard of Corsica, was in danger of death, and was saved by Marianne Ternano, his kinswoman, who, through the passageway of her home, had him go into the seminary, the barracks of the battalion."

Photograph by Maynard Owen Williams

THE MONUMENT TO NAPOLEON ON THE PLACE DU DIAMANT: AJACCIO

This statue to Corsica's "Little Corporal" is derisively styled "The Inkstand." The four standing figures represent Napoleon's brothers (see text, page 232).

in India, or on the Dalmatian coast. The men wear brown corduroy; sometimes their sashes are broad enough and bright enough to add pigment to the picture.

But the Corsicans are humble folk. They gladly subordinate themselves to the scenery, saying that the land is so beautiful that it needs no polychrome costumes to make it attractive. And when one sees with what indifferent success the town folk do wear colors, he quickly reconciles himself to the somber garb which stands out so modestly against the beauty of the land itself.

The Corsican is to France what the Georgian was to Russia. He is not constitutionally lazy; but the idea of subordination to man, time clock, or season is abhorrent to him. He would rather be a shabby gentleman than a rich servant.

Countless tiny terraces, where crops grow at such cost of labor as one finds among the Ifugaos of the Philippines or among the Chinese, testify to the fact that the Corsican is not truly slovenly. A certain thrift and foresight are habitual with him.

THE GREEKS GAVE CORSICA THE NAME "MOST BEAUTIFUL"

When the Greeks, no amateurs in beauty, called Corsica "Kalliste"—Most Beautiful—they referred to rugged coasts where blood-red rocks plunge deep into the sea, where a soft haze carries the succession of loveliness across wide plains, between tall mountains, to some distant snow-clad peak, all opalescent under the soft glow of departing day, where cascades pour their shower of pearls against rock cliffs as black as ebony.

Corsica is interesting because it is Corsica. With all its discomforts, the laggard land is worth a visit because it is laggard. Such unspoiled spots are so few in the modern world that one can tolerate petty inconveniences for the sake of knowing a people who have been little affected by modernism.

Photograph by Maynard Owen Williams

SCHOOLGIRLS GOING BACK TO THEIR CLASSES DOWN BY THE OLD SEA WALL OF AJACCIO

Photograph by Clifton Adams

GIRLS OF AN AJACCIO ATHLETIC CLUB RESTING IN THE PLACE DU DIAMANT AFTER AN EXHIBITION DRILL

Like their French sisters, Corsican girls have begun to take a lively interest in sports.

Photograph by Clifton Adams

THE OUTDOOR SHRINE OF A CORSICAN HOUSEHOLD

Here and there about the towns, on walls and on corners of houses, are statuettes of the Virgin or of some saint, which are decorated with flowers and before which lighted candles are placed on fête days.

The dainty vestibule through which I entered this interesting land was Ajaccio, a chameleon city whose soft tints change with every sweep of cloud and angle of sun, a city now old ivory set in blue, now mauve and gray against the purpling peaks.

AJACCIO, NAPOLEON'S HOME TOWN

Ajaccio was founded by the Genoese in the same year that a fellow-citizen of theirs, after chasing a dream across stormy seas, discovered America. Genoa did not comprehend at that time which was the main event and which was the sideshow.

In 1811, Napoleon, having been born there 42 years earlier, made it the capital of Corsica because his mother, Letizia Ramolino Bonaparte, desired it. Perhaps it is for this reason, as much as for the fact that he honored the town by being born there, that Ajaccio, alone among the cities of Corsica, still votes Bonapartist.

Photograph by Clifton Adams

CORSICAN BOYS ON THEIR WAY TO SCHOOL

Each has his own books and pen and ink. Their school day is a long one—from eight in the morning until five in the evening—but with frequent play periods. Boys and girls attend separate schools.

Photograph by Maynard Owen Williams

REPAIRING FISHING NETS ON THE AJACCIO QUAY

Although the present city of Ajaccio owes its existence to the Genoese, who founded it, tradition says that the original settlement in this vicinity was established by Ajax, the Greek hero, from whom the town derives its name. The earlier city was destroyed by the Saracens in the tenth century.

Ajaccio is Napoleon's home town. One is never allowed to forget that. But he did Corsica the great dishonor of quitting her shores, and few Corsicans seem to care much about him. To-day Napoleon is to Ajaccio what Fujiyama is to Japan and the Capitol to Washington—a sort of trade-mark of the place, with souvenirs of all sorts bearing his likeness and post cards picturing his home in the Rue St. Charles and his battles across half the world.

Officially, Ajaccio has done well by her renowned son. The boulevard of the city is the Cours Napoléon. The visitor who arrives by sea lands on the Quai Napoléon. There is the Rue du Roi de Rome and the Rue Napoléon. There is the Place du Premier Consul, the Casa Napoléon, Napoleon's Grotto, the Café Napoléon, and the Cinéma Napoléon. The people make the concession of smoking Petit Caporal cigarettes.

Napoleon's house is a barrack-like

Photograph by Maynard Owen Williams

MAKING LOBSTER TRAPS OF WITHES FROM STRIPPED MYRTLE BRANCHES: AJACCIO

structure, which it would be impossible to see in its proper perspective if the destruction of two houses opposite had not made possible the little Place Letizia, from which one can view the whole height of four stories, the upper three marked by eighteen regular windows, as well as the family arms and the tablet reading "NAPOLÉON I EST NÉ DANS CETTE MAISON LE XV AOÛT 1769." The people call it a three-story house, since in Corsica the lower story, which may be given to shops or stables, does not count.

IN THE ROOM WHERE NAPOLEON WAS BORN

The interior, like some interiors in Palestine, is a hindrance to imagination rather than a help. The furniture looks lonesome in the bare rooms, as if, after the intimate life it knew, it has been forgotten, even by the caretaker, who lives opposite and only enters the cold rooms when foreign curiosity promises a fee. There is the bed in which Napoleon was born, the chair in which his beautiful mother was brought from the cathedral with genius struggling for birth. But the strongest impression one has on seeing the Casa Napoléon is the beauty and completeness of Mount Vernon.

Ajaccio has two statues of its hero, neither very good, but both escaping the not-entirely-Prussian idea of picturing the great military genius in uniform. In the Place des Palmiers the statue shows the consul as a rather emaciated river god standing among four very wooden lions.

The statue on the Place du Diamant is much better. Yet the facetious among the people long since gave it the name of "The Inkstand." The story goes that the sculptor committed suicide because he failed to put a horseshoe on the free foot of the steed upon which Napoleon sits in the garb of a Roman emperor, holding a terrestrial globe on which Victory is poised (see page 227).

On the four corners of the pedestal are Napoleon's brothers, garbed as lictors. The figures are the work of four different sculptors and the pedestal of red granite is from the precipice of Appietto, which rises from the plain behind Ajaccio. As if this table ornament needed a couple of calendar pads flanking it, there are two tablets of Victory, at the

Photograph by Maynard Owen Williams

A CORSICAN LABORER BRINGING IN BRUSHWOOD MEETS A MILKMAID HOMEWARD BOUND FROM AJACCIO TO ALATA

Photograph by Clifton Adams

RETURNING TO THEIR CONVENT

These two nuns are bringing to Ajaccio produce for themselves and forage for the burro from near-by fields.

Photograph by Clifton Adams

THE EVENING MEAL

Some of the dining-rooms of Corsican peasants are spacious and filled with fine old furniture and many queer pieces of bric-a-brac.

bottom of which there are circular benches where old men sit and children play horse.

Bastia has the only other statue of Napoleon that I have seen in Corsica, and there, too, he is pictured in flowing robes. These statues may lack something of the Michelangelo touch, but the last two reveal a robustness and erect bearing that one little suspected of Napoleon.

The robed statues in Corsica come as a welcome relief to those who instinctively picture the author of the best sentence about the Pyramids as an undersized soldier ever trying, by pressing a spring concealed beneath his third coat button, to make his caricature head, with its transverse hat, disappear between his round shoulders.

STREET LIFE IN AJACCIO

But, quite aside from Napoleon, Ajaccio is well worth knowing. It is a place in which to dream, to soak in the warmth of the sun, and to pass idle hours in the contemplation of mountain and plain and sea. Its climate is such as one associates with oranges and roses at Christmas.

People from the outside world will tell you that the Ajaccien is lazy. He is. Ajaccio never heard of a time clock, and would not punch one if it were introduced. As long as there is sun, there are crowds to enjoy it.

Boys play marbles, pitch pennies, or kick anything which by the stretch of the youthful imagination can be considered a football. Little girls, with arms full of rubber balls of various sizes, keep three of them bounding at once against wall and sidewalk and throw in a few slaps of the hands behind their backs to show that dullness is not necessarily allied to leisure. Young Corsica vibrates with energy; animal spirits abound. It is evident that it takes training and age to steady down to slow-speed pastimes.

Young men and women promenade back and forth—an attractive, well-mannered lot—with school books on their

Photograph by Maynard Owen Williams

ON THEIR WAY TO THEIR INLAND HOME AFTER A VISIT TO CORSICA'S CAPITAL ON THE COAST

Note the pancake-shaped grass hats, a peculiarity of the Corsican woman's costume.

arms. Amid much wasting of time, Ajaccio has many crowded schools and eager pupils.

The gravel square of the Place du Diamant is always dotted with people whose talk, be it in French, Italian, or Corsican, is sure to be accompanied by much wrist movement. One of the first things a Corsican chauffeur has to learn is to curse effectively without hurling his car at the awkward carts which wait till the last moment and then swing their long loads across the narrow road.

Down to the left, near the sea wall, there is the sunning place of the old men. The grandmothers always seem to have toddling descendants whose first steps in life require supervision. But to the old men children are only a temporary distraction.

During the brief recess of the parochial school, long queues of noisy children fill the street which runs down to ancient bastions whose only enemy is the sea. But back against the wall, which reflects the heat onto backs long bent with age, there is always a pathetic group of fine-faced old men, soaking up the warmth and talking politics.

Just around the corner a dozen women and girls, with cold-numbed feet, wet in spite of heavy wool socks and wooden shoes, are washing their linen at set tubs, for which they pay four sous a day.

NO EVIDENCES OF THE STRENUOUS LIFE HERE

The Ajaccien is lazy. But who among us has the right to cast the first stone of criticism? The visiting Britisher uses gun and dog as thin veils for vagabondage. The modern Miss Nevils who swarm Ajaccio in winter dab away at sketches which may or may not ever decorate a wall, but which serve as an excuse for sitting in the sun and drinking in the beauty of the place.

True, the Britisher is on a holiday. But by that very sign he is doing what he likes. And that is what the Ajaccien is doing—passing pleasant hours amid pleasant scenes. He knows that time is money, and has no desire to hoard it or multiply it. The fact that he has little

BAKING CORSICAN PRETZELS

Photographs by Clifton Adams

GLOVE PROSPECTS FOR ITALY

One of the home industries of Corsica is the preparation of kid skins for exportation. Madame said these skins drying in the sun before her home would be sent to Italy to be made into gloves.

Photograph by Clifton Adams

ROASTING COFFEE

The berries are always bought green and roasted over a fire of maquis twigs or charcoal in an iron roaster which is a part of the kitchen equipment. The beverage prepared in Corsica is black, strong, and bitter.

appreciation of art or scenic beauty is just like the flowers that bloom in the spring, tra-la, and has nothing to do with the case. The sunshine warms the cockles of his heart and he gladly welcomes it.

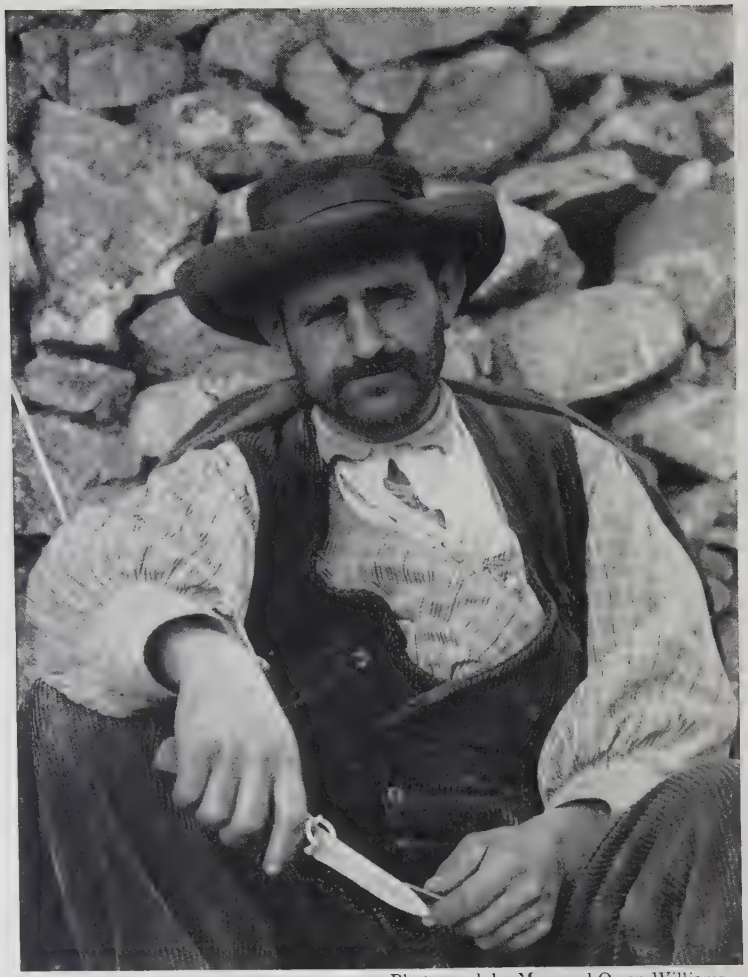
Ajaccio sits astride Monte Salario, from which the stone for many of its well-built homes was obtained, and looks off to a crown of mountains stretching from the east to the south. The bright jewel of this circlet is Monte d'Oro, 7,845 feet high and snow-clad for a good part of the year. The green hill which is background for pink and cream Ajaccio splits the city into the form of a Y with long, widespread arms and a short, thick base where the old citadel stands.

The right arm of the Y is the Cours Napoléon, which runs almost due north and changes from a city street into a Route Nationale near the railway station. The other arm, the Boulevard Grandval, runs southwest and terminates at the Place du Casone, a bare drill ground, beyond which two tip-tilted rocks form the

THE CAMARADERIE OF A CORSICAN WINE SHOP

Photograph by Clifton Adams

The hanging cluster of maquis shows that "good cheer" is to be had. Some of the little shops serve meals at noon and at night; between hours the customers seek diversion with cards and light wines of the country.



Photograph by Maynard Owen Williams

A CORSICAN SHEPHERD OF AJACCIO

There are communal grazing grounds, for which such men pay a tax for the privilege of feeding their flocks upon them. The knife and the stick to whittle are as frequently in play as on our own farmsides.

Photograph by Clifton Adams

THE CORSICAN GOURD IS USED AS A WINE AND WATER FLAGON

These gourds are highly prized by the peasants, who often decorate them with fancy designs. The old coach-driver is enjoying a cool draft from the canteen of a friend from the vineyards of Cap Corse.

Photograph by Clifton Adams

THIS CORSICAN GRANDMOTHER HAS BEEN ACCUSTOMED ALL HER LIFE TO THE ROUGH TASKS OF THE HOUSEHOLD

The old women seem as active as the younger ones and very few are to be found sitting in the chimney corners.

Photograph by Clifton Adams

TWO GIRLS OF SOUTHERN CORSICA

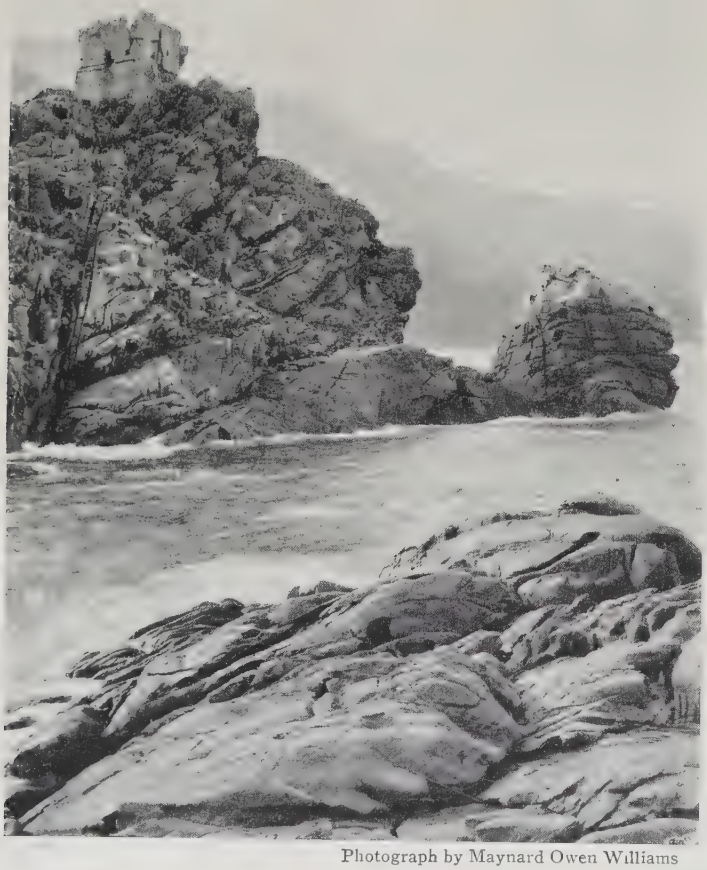
Napoleon Grotto, in which the youthful genius is said to have studied.

History is not likely to repeat itself here, for the thud of the football, so irresistible to Corsican youth, is heard at all hours on the Place and the grotto is being inclosed in a formal garden. On May 5, 1921, Marshal Franchet d'Esperey here laid the first stone for Ajaccio's third monument to her most distinguished son.

AJACCIO'S BROADWAY AND FIFTH AVENUE

Below the Cours Napoléon, which is Ajaccio's Broadway, there are the two sections of the port, whose broad quays are always the center of interesting, if not feverish, activity. Here the fishermen spread out their nets to mend. Here they boil their tanning solutions in open caldrons into which the nets are periodically dipped to preserve them. Here, on slabs of marble, they drop molten lead, which, when cool, is bent between thumb and fingers to form sinkers for the nets. Small octopuses are cut up to bait the trolling lines, neatly coiled in low baskets, around the edges of which are stuck shining circles of sharp-pointed hooks.

At midnight the fishermen go out into



Photograph by Maynard Owen Williams

THE OLD GENOESE TOWER AT THE MOUTH OF THE PORTO

the Gulf of Ajaccio, often beyond the Îles Sanguinaires. At 2 or 3 o'clock the next afternoon they return empty-handed or well loaded, according to their luck.

NO FEAR OF THIEVERY IN CORSICA

Here the island steamers dock, scattering their cargoes about the open quay, for rain is infrequent and a few tarpaulins amply protect the valuables, which are left outdoors in this land of the vendetta, where the shipper has more to fear from the deliberations of the customs officials than from thievery.

The fish and vegetable markets are there, with women doing the buying and selling for the most part, and on two sides of the little park small stands are erected every morning. These are the butcher shops, with leg of lamb and young goat the main commodities.

Between the Cours Napoléon and the quays there are dirty back alleys, where washing hangs in the cosmopolitan back-alley way, where stables are concealed from the eye, but not from the nose, and where mouse-colored donkeys munch their chestnuts in a way that makes corn on the cob seem a silent feast and that must surely increase the price of marrons glacés from Paris to Gopher Prairie.

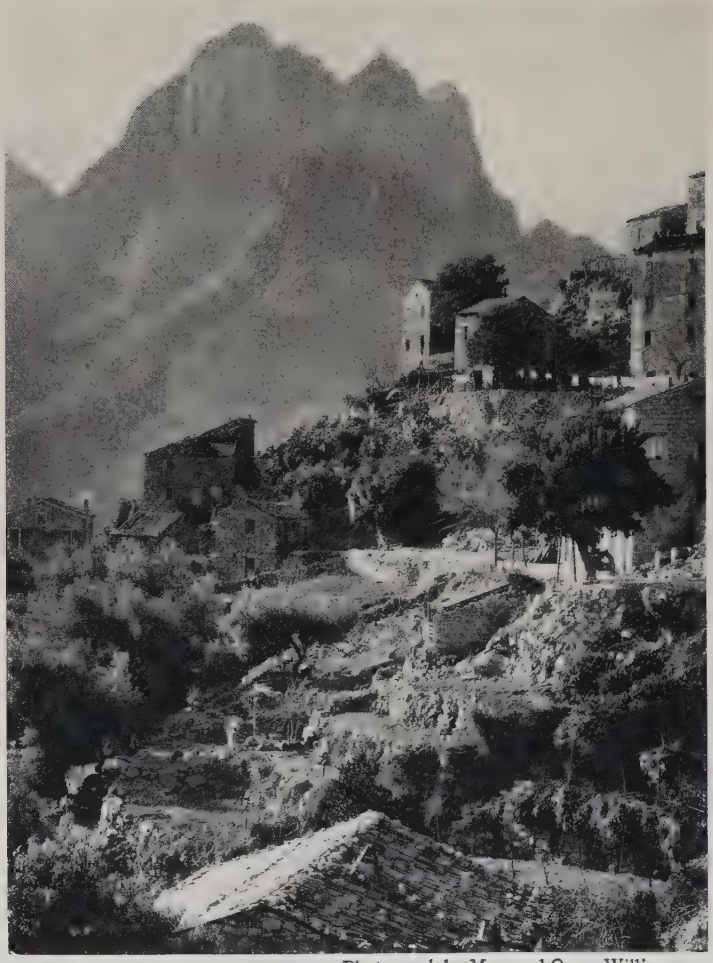
Even the street on which the Maison de Napoléon stands is a foul alley. When the great general at St. Helena said that with his eyes closed he would know his native land because of its perfume, he was not referring to his native street. That smells like Jerusalem and Damascus.

The Boulevard Grandval is the Fifth Avenue of this town of 22,000, and below it is the Boulevard Lantivy, the sea drive and promenade of society. An extension leads to the Genoese tower behind the Îles Sanguinaires, a charming road of seven miles, with olive orchards, orange groves, and maquis on the north and the ever-fascinating gulf dashing its waves almost to the roadway on the other side.

All the loveliness that verdure-clad hills and the sight of distant mountains can give a place, all the lure of the dancing sea, is Ajaccio's. But the poorer children know not the meaning of the word handkerchief; there are odorous little courtyards that remind one of the khans of

Syria and Turkestan; by no stretch of generosity could the cafés, where men play with greasy cards and discuss politics, be described as bright or cheery; the tiny donkeys coming in at nightfall dragging carts piled mountain-high with rough shrubs for fires and ovens emphasize the inadequate scale on which comforts are provided; the whack of the laundry near the cathedral reminds one that in Ajaccio cleanliness is not only next to godliness, but next to impossible; and leisure has left a stoop of defeat and impotence on once manly shoulders.

From a distance, Ajaccio is a fairyland. The kindly sun, which harmonizes the light blue and green and pink and ivory beneath maroon stenciling or fretwork and red tile roofs, bathes the scene in the magic light of a stage spectacle. The sky, the sea, and the balmy air are the kindliest elements in the life of the people.



Photograph by Maynard Owen Williams

THE WESTERN END OF OTA

Built in a natural amphitheater at the foot of the Capo d'Ota, this village has a population of 900.

AT THE FÊTE OF ST. ANTOINE

Of all the saints beloved by the Ajacciens, St. Antoine is the favorite. Take any group of Ajaccio boys and you will find a football team of Antoines for every Napoleon. I am not sure but each Napoleon could have a company or a regiment of Antoines for his own. On the 17th of January hundreds of people leave Ajaccio to climb to the tiny chapel between green Salario and the rocky Pointe de Lisa, where the principal fête is held.

The flocks and swine had been blessed before I arrived. Not sheep, but goats, had received this benediction, and these alert animals climbed to their hillside pastures soon after, leaving their hard-trodden fold as a prime place in which to pitch pennies.

The desire to be present at this blessing of the flocks had brought me to the tiny chapel before the clouds had dispersed and when the air was still biting cold. At that hour the bad road was full of donkey carts carrying oranges, bottled goods, crockery, tables, and a hurdy-gurdy to the scene of the day's festivities. But there was plenty to watch and it was then possible to enter the little shrine standing stark on the watershed from which one

looks down to sea and gulf on either side. As the sun came out, the base of the chapel reflected a warmer color from great piles of oranges, tied into bunches, each with a sprig of feathery mimosa, spring's first new growth.

On a half-dozen open fires pots of coffee were already a-bubble, and one table was doubly popular because liqueur glasses of absinthe were being surreptitiously poured out to turn a glass of water chalky before it was gulped down.

"I thought that absinthe was forbidden," I said to one drinker.

"Yes, it's forbidden," he replied, between gulps.

All this time citizens on foot and in carriages were coming up the hill, with now and then a heavy cart piled with merrymakers and their food. Then came the motor cars, which enabled lazy folk to dash up to pay their respects to the Saint and return to town in time for an indoor meal.

Indoor meals seemed to be the last desire of most of the visitors, and at 50 places among the maquis and in the shelter of the great rocks small open fires were being built, each of which was a shrine of gustatory fellowship.

HURDY-GURDY AND ACCORDION THE DANCERS' ORCHESTRA

The feast of St. Anthony is the occasion when the town-dweller escapes for a day to live in the maquis, and there was more laughter and good fun out there under the sky than in all the few amusement places that Ajaccio boasts.

Out along the hills twoscore of armed men were combing the hills for sanglier, that wild boar whose flesh makes such delicious eating.

The hurdy-gurdy and an accordion rivalled each other in providing music for those who cared to dance. Young Corsica takes its dancing seriously. Walking around the floor to music with an arm around a lady has no appeal to the young Ajaccien. Every book store, along with its several varieties of books on etiquette, has its guides to the Boston, the schottische, the tango, and the mazurka, and somewhere or other the few who do dance pick up a variety of steps which is amazing to the tyro and would probably come as a revelation to many a professional dancer.

So it took the brightest airs that hurdy-gurdy and accordion could furnish before the young folks were ready to reveal their art on that rough field. But, once started, they never seemed ready to stop. More than half the dancers were not couples, strictly speaking, but town youths in blue denim and Apache caps, with highly decorated shoes laced so close to the toe as to give the rudest foot an effeminate appearance.

The accordion had won most of the crowd away from the hurdy-gurdy, the absinthe had all been drunk, and the family parties among the rocks and underbrush had broiled their meat and eaten it before I left. But four-foot candles, tied to boards like splints, were still being brought up from the town and the less rustic urbanites were still plodding up the rough road in their painful patent-leather shoes.

In the afternoon I rode out to Mezzavia, where, in the shadow of an aqueduct, there is another small chapel of St. Antoine.

In spite of the ring toss for bottles of wine, the many games of chance, and the general money-changers-in-the-temple aspect of the place, this gathering had a more religious tone than the merrymakers in the valley of Ajaccio; but there were also more fine gowns and low slippers, for the road to Mezzavia, even if one walks the entire distance, is not hard.

A TOURIST INVASION OF THE ISLAND IMPENDS

Neglected heretofore, Corsica is coming into vogue. One of the great French railway systems is arranging for motor services in connection with the steamers from Nice and Marseille, and last winter a half dozen simple but clean hotels, under Swiss direction, were being planned, so that even those who insist on standardized travel arrangements might visit most parts of the island.

But to appreciate the Corsican one must know him, and a throbbing motor car which relentlessly puts hills behind and rolls past splendid points of view at 30 miles an hour does not give a chance to know those who do not wear their hearts upon their brown corduroy sleeves, for all their traditional hospitality. One can't show very sincere hospitality to a cloud of dust and carbon monoxide gas.

Photograph by Clifton Adams

A SMILE OF WELCOME IN CORSICA

While beauty is said to be characteristic of Corsican scenery rather than of the island's inhabitants, the abundant rich red hair of this maid of Bonifacio is an asset of which any Parisienne might be envious.

Photograph by Clifton Adams

THE FRAGRANCE OF SUCH FLOWERS HAUNTED THE DREAMS OF THE EXILED NAPOLEON

A‘ most seasons of the year, the fields, forests, and highways of Corsica are abloom with many varieties of wild flowers. These graceful spikes of white blossoms are known to the peasants as "Dogstooth."

Photograph by Clifton Adams

A MOMENT OF LEISURE IN A FIELD OF NEW-MOWN HAY, NEAR ÎLE ROUSSE, NORTHERN CORSICA

Nineteen-year-old Joanne, who wears a white headcloth and a striped apron over her dress of coarse black, harvests hay with the men and boys in her father's field. Her pitchfork was "made in U. S. A."

Photograph by Clifton Adams

GENDARMES ON A MOUNTAIN ROAD

These are the types of policemen who have done much to discourage the custom of the vendetta since Corsica came under French rule.

Photograph by Clifton Adams

SUCH SYLVAN SCENES RECALL THE FACT THAT THE GREEKS GAVE CORSICA THE NAME "KALLISTE"—MOST BEAUTIFUL

Giant ferns are to be found all over the island, especially in the forests and on the banks of the mountain streams. This olive grove with its green carpet of ferns borders the beach at Calvi.

Photograph by Clifton Adams

A PRIMITIVE CHARCOAL KILN

Along the mountain roads the larger trunks of maquis are cut into short lengths, stacked in rough cones, covered with earth and burned. The charcoal product is then taken home or transported to the ports on the backs of donkeys.

Photograph by Maynard Owen Williams

LOOKING DOWN UPON AJACCIO

"The green hill, which is background for pink and cream Ajaccio, splits the city into the form of a Y" (see text, page 237).

Photograph by Clifton Adams

A CORSICAN PEASANT

The peasants and laborers of the island generally wear hobnailed shoes, corduroy trousers and vests, plaid shirts, and sometimes smaller fancy shirts of the same material in addition. Broad red sashes occasionally provide a dash of color for the costume.

Photograph by Clifton Adams

GRANDMOTHER WEARING THE UNIQUE PANCAKE-SHAPED CORSICAN HAT

This peculiar sunshade perched on top of a cap is still worn in certain mountain districts of the island (see also illustrations, pages 233 and 235). It is made of twisted woven brook grass. The color in the costumes of peasant women that one naturally associates with southern European peoples is lacking in Corsica.

Photograph by Clifton Adams

DELIVERING THE MORNING'S MILK

There are few cows in Corsica and most of the milk is obtained from goats, which are handsome creatures of energy and spirit (see page 278).

Photograph by Clifton Adams

YOUTHFUL PIETY BEFORE A WAYSIDE SHRINE

Some of these small shrines or "chapelles" along the roadsides erected to the Virgin Mary or some favorite Corsican Saint are hundreds of years old.

Photograph by Clifton Adams

THE WHEAT HARVEST OF A CORSICAN FARMER

After the grain has been threshed from the heads of the wheat by the hoofs of cattle, a sieve is used to separate the grain from the chaff. This farmer is carefully measuring his wheat before putting it in sacks, to be taken to the granary on the back of the burro. The type of wooden shovel and fork shown in the illustration is said to have been introduced by the Moors. The cross in the pile of grain is a symbol of supplication for a bountiful crop next year.

Photograph by Clifton Adams

THE CORSICAN, UPON THE SLIGHTEST PRETEXT, DOES HIS WORK OUT-OF-DOORS

This itinerant china mender has established his shop in a shady spot on the sidewalk and, surrounded by interested spectators, is making as good as new the housewife's favorite dishes.

Photograph by Maynard Owen Williams

A STREET IN THE OLDER SECTION OF BASTIA

Bastia is more alive to the present and the future than any other town of the island. Olive oil, the wine of Cap Corse, and some of the finest lemons in the world are shipped from its quays to France and Italy. Ajaccio, frequented by strangers, has been called the Nice and Bastia the Marseille of Corsica. The city inherited its skyscraping tenements from Genoa.

Photograph by Maynard Owen Williams

FISH NETS AND LOBSTER POTS BESIDE THE QUAY AT CENTURI

Centuri, on the west coast of Cap Corse, the northernmost peninsula of the island, was the port at which Boswell landed when he visited Corsica. "The prospect of the mountains covered with vines and olives," he wrote, "was extremely agreeable and the odour of the myrtle and other aromatick shrubs and flowers that grew all around me was very refreshing."

Photograph by Maynard Owen Williams

MORNING LIGHT SPREADING OVER THE QUAYS AT BASTIA

The commercial metropolis of Corsica, with a population of 30,000, was founded by the Genoese in 1380. Overlooking Bastia is the village of Pietranera, scene of the thrilling incidents in Prosper Mérimée's famous novel "Colomba," which familiarized the world with the vendetta.

The contemplated linking of original Corsica with the sophisticated Côte d'Azur is merely a marriage of convenience. Corsica and the Continent have different tastes and characters. It is to be hoped that mercenary considerations will not succeed in bringing about this union, in which Corsican characteristics must sooner or later be subordinated to that cosmopolitan mixture of cultures that makes a concierge on the Côte d'Azur the most perfect machine and the least interesting human being in all the world.

THE ISLAND IS SHAPED LIKE A TORTOISE

Before circling the Corsican coast, it is well to have in advance some idea of what the trip offers. Corsica has usually been likened to a bottle of perfume whose subtle odor is distilled by a genial sun from the sweet-scented shrubs of the maquis.

To one who looks at Corsica from the west instead of from the north, it is a huge tortoise. The long head of this island beast is Cap Corse, with Bastia, the island's largest city, at the nape of its neck and the insignificant port of St. Florent tucked closely under its chin (see map, page 224).

On the west coast four large gulfs, each made up of several smaller ones, separate the feet of this legless sea monster. Northernmost and loveliest of all is the Gulf of Porto, whose sharp wedge seems to have split asunder the hills behind it. Next to the south is the wide Gulf of Sagone, fed by sluggish, though once agile, streams.

Then the Gulf of Ajaccio, whose quieter beauty, like that of the Bay of Naples, matches the savage charm of the Gulf of Porto with its rouged lips. The Gulf of Valinco, though less widely known, has its champions.

Where the back breaks into a sort of tail is Porto Vecchio, at the only considerable interruption in the low-lying coast between Cap Corse and Bonifacio.

As to the interior structure of this animal, the main line of mountains is slightly bowed from northwest to southwest, and the back of the beast lacks the hard shell that one would expect, while the entire underpart of the body is armored with granite and porphyry and fitted with fierce claws of rock which clutch steeply into the sea.

Its coasts do not constitute the true Corsica. They form the twilight zone between the outer world and this land whose resistance to change and passion for independence make more remarkable the true hospitality of its people.

We could have wished for nothing lovelier than our ride across the plain behind Ajaccio. Near at hand, the dark green of olive groves; beyond, the rose-red shoulder of the Rocher Gozzi, of hardest granite, but resembling some sandstone hill of Petra, its color subdued by a darkened sky. Then a dull blue approach to the skirts of Monte d'Oro, whose snowy head was lost in clouds.

We passed under the aqueduct which supplies Ajaccio with water when the gendarmes do their duty. These armed guards are sometimes stationed along its course to keep the farmers from diverting the water to their fields. Then we climbed to our first col, or pass.

Travel in Corsica is just one seesaw of ups and downs, ins and outs. But the mountain passes justify their existence, whether they run through heavy forests to a thickly timbered saddle or reach out to a point of land that looks down on stormy gulfs, each more beautiful than the previous one. That first tiny pass, less than 1,000 feet above the sea, was a foretaste of many that were to come.

To the south was the rich plain at the head of the Gulf of Ajaccio, the plain from which Letizia and her children fled, with a distant glimpse of the Tour de Capitello, whence Napoleon himself fled from danger to fame. Across the blue-black bay were the mountains which face Ajaccio.

SAGONE'S GLORY HAS VANISHED

Ahead, our yellow road wound deeper into the hills; but on our left, high on the side of the hill of the Pozzo di Borgo, was the Château de la Punta, a misplaced structure built of materials brought from the Tuileries in Paris, but one from which there is an incomparable panorama of the entire backbone of Corsica from Capo Tafonato to the Incudine.

Farther north lay the Gulf of Lava, near which the most prominent of the present-day bandits is said to have his retreat.

Every climb, which opened up scenes

Photograph by Maynard Owen Williams

A ROADSIDE FOUNTAIN AND LAUNDRY

Little of the water goes to waste, as there seem to be waiting women always at hand taking their turn to do laundry work.

ever more majestic, brought one to a curving descent leading to intimate relations with a softer beauty. Down we swept to the gulf, rounding the tower of Capigliolo on its promontory, and out of Sagone before we knew we had reached it. From the turnings above the hamlet we had glimpsed the port at the far end of the yellow beach and had expected that the town would be there. But what there is of Sagone is close to the hill over which we had come, and we were several hundred yards along the splendid eucalyptus avenue, which is supposed to offset the miasma of this tiny corner of plain, before we knew that the meter had clicked off another big name on the map.

Sagone was once the seat of an epicurean bishop whose feasts became a scandal and called forth the censure of Gregory the Great. The Barbary pirates came, wrecked the cathedral, and left Sagone a ruin; so that to-day its tiny campanile even lacks a church.

That is the story. The fact probably is that the powerful *Anopheles* had more to do with it. In Corsica, as in Panama, the mosquito has done more than its share to rob France of glory and wealth. The practically unimproved port is served by infrequent sailing vessels, which touch here to carry off the accumulation of charcoal from the hills (see page 250).

IN CARGÈSE, HOME OF GREEK REFUGEES

The Sagone, which is a river on the map and less than a creek in reality, here empties into the sea through narrow backwaters lined with high rushes. After crossing it on a new cement bridge, one strikes west once more, rounds one hill after another, and beyond well-kept olive groves sees, seated on a low saddle between two hills, each with its ruined tower dating from several centuries ago, the little town of Cargèse, whose most interesting superficial feature is that a Greek and a Roman Catholic church face each other across a narrow valley full of gardens.

THE COL DE VERGIO, THE HIGHEST PASS IN CORSICA—ELEVATION, 4,803 FEET

By this pass communication is maintained between the valley of the Porto and the valley of the Golo, except in winter.

Photographs by Maynard Owen Williams

EVERYBODY RIDES BUT FATHER ON MOVING DAY IN CORSICA

Photograph by Clifton Adams

FRENCH BRIAR PIPES IN THE ROUGH

The stumps of bruyère grow on the mountain sides, among the maquis, and their gnarled knotty roots are dug up and brought to the little sawmills, where the rough blocks for pipes are sawed out.

I had been led to expect that here I would find visible traces of the Greeks who settled in Cargèse just after the Boston Tea Party. Theirs was a strange story. A century before, these Peloponnesian Greeks, tired of the tyranny of the Turk, asked Genoa for a place where they could live in safety. The Genoese welcomed them and assured them freedom of religion and municipal government. The first settlement, made up of about 700 people, was on the hills between the present site of Cargèse and Sagone.

They remained faithful to Genoa throughout the Corsican struggles for freedom. In 1731 their villages were burned, and they fled to Ajaccio, 25 miles away. When Corsica was ceded to France, M. de Marbeuf had the present church and village of Cargèse built for them, and to-day one of the main streets and an ill-kept café are named after this benefactor of the Greeks, who was governor in Corsica in Napoleon's day.

At that time the 110 families still spoke Greek, wore Greek costumes, and worshiped according to Greek form. At first they did not have much to do with the Corsicans, who surrounded and persecuted them, but when their industry aroused jealousy they settled the matter through intermarriage rather than through recourse to the vendetta or open war.

Although I was assured that there are still some Greeks in Cargèse, I could not find any, and the Greek priest looked as if he would be more at home in the Sorbonne than in Athens.

GREEK CUSTOMS, COSTUMES, AND FEATURES ARE GONE

Cargèse, for all its interesting history, is to-day an uninteresting town. If the people are unusually industrious—and

Photograph by Maynard Owen Williams

A SNOW-CLAD SHOULDER OF MONTE ROTONDO FROM THE RAILWAY TRACK NEAR VIVARIO

Rotondo is the best-known peak in Corsica, and for a long time was thought to be the loftiest. It is easily accessible from the fortified town of Corte, the ancient capital of the island (see page 275).

any reasonably industrious man in Corsica is unusually industrious—it was not evident to the naked eye.

The women were busy washing clothes, carrying water, gathering olives, cleaning the streets before their houses, and tending babies and hens; but the only man in Cargèse that I saw really working was in a small olive-oil mill. He swung the lever that depressed the screw and sent the oil trickling out of its straw or wicker mats into a none-too-clean tub.

The Greek customs, costumes, and features are gone. Cargèse has had a romantic life, but the camera shows no trace of the ethnological difference between it and its neighboring towns. Only outside do well-cultivated fields and well-kept flocks proclaim that some remnant of the original Greek industry still remains.

LABOR IS CHIEFLY VOCAL IN CARGÈSE

A former writer saw there some women so lovely that it took him a page of adjectives to describe them. Possibly scouts from Hollywood have taken them away and he thereby missed an oppor-

Photograph by Maynard Owen Williams.

IN THE MAIN THOROUGHFARE OF SAGONE

The autobusses from Ajaccio, Vico, and Ota, via Piana, all meet here. There are not more than a dozen houses in this hamlet, which once was a wealthy community.

tunity to record photographically a fact that no longer obtains. Not a Mona Lisa nor Greek goddess did I see.

Some enemy of the town recently left there a consignment of the most offensive green paint that ever assailed from afar the human eye—a color which must have been conceived in a delirium. It has become the custom to paint the shutters of the pink and light yellow houses with this awful stuff. One of the most pretentious houses in Cargèse stands between the two churches, and this disfiguring paint has rendered it the most atrocious edifice I have seen in an island where barrack-like buildings have the good taste to be inconspicuous, if not entirely pleasing to the eye.

One cannot tell how sleepy the town of Cargèse is; he can only say that the Ajacciens find it slow. The labor is largely vocal. The shepherd lies in the sun and shouts or whistles to his flock. The hired man in the olive-oil mill, by shouting at him, scares speed into the worn Samson of a horse that turns the rollers. The postman stands outside and pages the people for whom he has mail. One could achieve fame in Cargèse by getting his name on a good mailing list, for the postman is an energetic Stentor, even if lead has replaced the wings of Mercury upon his reluctant feet.

The women wear a peculiar straw hat like a child's beach hat, which is, of course, black. They are as industrious in Cargèse as elsewhere. In Corsica it is not necessary to note whether an approaching form wears skirt or trousers. If it carries a burden, it is probably a woman.

PIANA HAS NO REPUTATION TO UPHOLD

Piana, an attractive little town backed by the Calanche and overlooking the incomparable Gulf of Porto, comes as a distinct relief.

There are probably as many men sunning themselves in front of the church in Piana as there are in front of the two churches of Cargèse. The little girls who bound their rubber balls, and then whirl quickly to bound them again, betray as great a need of underwear as in Cargèse. The boys are as apt to start a hue and cry that will fill the picturesque old

Photograph by Maynard Owen Williams

A PUSHCART SALESMAN AT EVISA, IN THE HEART OF THE MOUNTAINS, NEAR A BEAUTIFUL CHESTNUT FOREST

streets with undesired crowds of children, each standing at attention, with his or her tummy pushed out in pseudo-military style, and each desiring that his or her picture be more prominent than the rough stone steps, the fine old women, or the humble donkeys, which do so much to give a country village its tone.

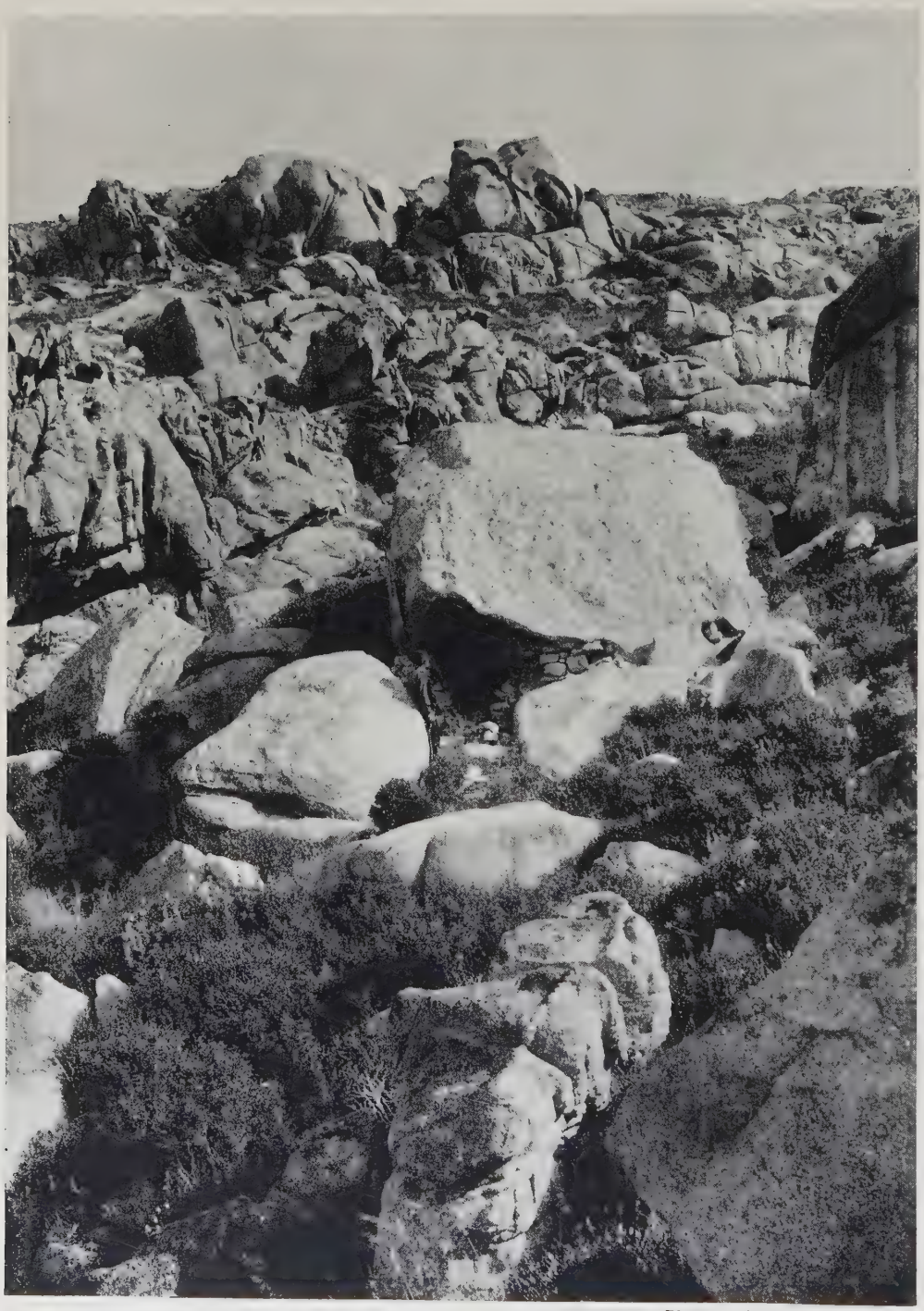
Piana, however, is known not for its classic ancestry but for the grotesque forms of red granite just beyond and for its view across the bluest of gulfs to the reddest of peninsulas. Hence it has no unusual reputation for cleanliness or industry to uphold. It is a Corsican town, much like many another, except that its clock keeps tolerable time.

The best hotel is a tall, narrow structure at the extreme edge of the town. The furniture is excellent and not overheavy. Cleanliness seems almost tangible, the food is fine, the outlook unsurpassed. The silver tea service would do credit to a tourist hotel in Nice and the ivory-handled knives are of unstainable steel. It is another of those paradoxical surprises with which Corsica loves to confuse one.

One can eat a lamb's head there, split in half, with the tongue, cheeks, and brains done to a turn, with a relish that the same rather gruesome but very tasty dish would not inspire amid less attractive surroundings. Altogether, Piana, like Ajaccio, is a place in which to tramp and climb and enjoy the view and the tonic air. It is one of the places in Corsica that rewards a long stay, for the light on the red rocks is never twice the same and the fantastic forms in the Calanche continually intrigue one's interest.

AN AMAZING GALLERY OF FANTASTIC FORMS IN THE CALANCHE

The Calanche forms one of the most unusual sights in the world. Sharp tongues of red granite serrated into a thousand fantasies descend from the peaks of La Pianetta and the Capo d'Orto to the blue waters of the Gulf of Porto. About half way down to the water they are cut by a serpentine road which now overlooks seemingly bottomless ravines and now is overhung by great masses of granite that, when one looks up and sees



Photograph by Clifton Adams

A SHEPHERD'S REFUGE AMONG THE ROCKS

By a queer caprice of Mother Nature, some of the great boulders along the west coast of Corsica have been hollowed out, and the shepherds use them as shelters during sudden summer showers.

the clouds pass over them, seem about to topple upon his head.

Everywhere that plants can find foothold there are maquis or pine trees whose green adds verdancy to the already colorful scene. Here is no such open beauty, such tremendous expanse of Nature's canvas as awes by its very size and makes the Grand Canyon indescribable. Nor has the rock those exquisite grainings that make the sandstone of Petra resemble choice bits of ornamental wood. But the grotesque forms into which titanic forces have carved the stone make them more intriguing than the great rock masses of Arizona or the Nabatean temple tombs of the "rose-red city half as old as Time."

Gargoyles glare from a hundred jutting rocks. The heads of puppy dogs look out from granite kennels high against the north entrance to the chaos in red granite, and two lovers, a little stiff in their attitude, but admirable in their constancy, stand near the upper exit.

Photograph by Maynard Owen Williams

A FANTASTIC FACE OF GRANITE, "THE SPIRIT OF THE CALANCHE"

The various rock forms of the Calanche, near the Corsican coast village of Piana, are hard to photograph in such a way as to show the details, which spur the imagination to see strange figures there. Here, high to the right, is a rock form, far from the beaten path, which suggests the malign spirit of the whole formation, which is a veritable nightmare in stone (see text below).

There is a giant lion high on the slope, a truly regal figure. A huge tortoise stands on a point of rock which the road-makers have detached from its parent mass. A witch with a hatchet chin and a criminal brow starts out from the stone in a spirited way that suggests night rides on a broomstick, and way down on the first edge of the group I found a fierce face which surely must be the malign spirit of this nightmare in stone (see illustration above).

There are forms from which one almost expects to hear the deep thunder of a mighty organ, whose irregular pipes assume an almost artificial symmetry, as though they had once been actually tuned to the breezes which sweep in from the sea. A great gopura, as overdecorated by Nature as are those of Madura by the hand of man, is so perfect a replica that one can imagine brown bodies bowing before equally brown and greasy idols, while temple gongs jangle discordantly beside some stagnant pool.

Photograph by Clifton Adams

A ROADWAY BORDERED BY EUCALYPTUS TREES NEAR A VILLAGE ON THE GULF OF PORTO

The eucalyptus tree is found throughout Corsica. The dry leaves are used by the peasants to make a cough syrup.

Photograph by Clifton Adams

LOGGING IN THE FOREST D'AITONÉ, NEAR EVISA

The lumbermen in their picturesque garb, working in concert to the shouted orders from their chief, pull on their L-shaped logging tools and slide the great pine beams over the rocks and down the hillsides to the cart roads below.

TALKING POLITICS IN CALVI

It was during operations at Calvi in 1794 that Lord Nelson's right eye was destroyed by gravel driven into it by a cannon shot which struck the ground close to him.

Photographs by Maynard Owen Williams

THE ALGAJOLA MONOLITH, LYING WHERE IT WAS QUARRIED AND DESERTED

This little town in northwestern Corsica is famous for its stone, the pedestal of the Vendôme Column in Paris and the cover of the sarcophagus of the Emperor Napoleon having come from Algajola quarries. This column was cut with a view to its erection at Ajaccio, where it was to be surmounted by a statue of Napoleon, but the expense of transportation and preparation proved too great and the project was abandoned.

Photograph by Maynard Owen Williams

HOGSHEADS OF CITRONS, PACKED IN SEA WATER, AT ÎLE ROUSSE, READY FOR NEW YORK

Île Rousse, which was founded by Paoli in 1758, derives its name from three red granite islets at the entrance to the harbor.

The Calanche forms a true test of such imagination as sees in cloud forms interesting pictures and half-conceived dreams. But the hard granite of Piana has none of that fleeting loveliness that one finds in a sunset cloud scudding before the wind. Its grotesque shapes have hardened there, so that even the unimaginative can be rushed by in motor cars and have pointed out to them the stock sights of the place. The day may come when they will be numbered in white paint to correspond to similar figures in the guidebook!

As one passes through this gigantic joke played by some long since extinguished fire, he finds the north slopes of these red rock masses shrouded in maquis. A turn of the road carries him out of this phantasmagoria of porphyry as suddenly as the pass above Piana introduced it.

The Gulf of Porto, which till then had been a distant sea of concentrated bluing

Photograph by Clifton Adams

AT THE FOOT OF MT. STELLO, ON THE WEST COAST OF CAP CORSE

Nonza, an old feudal town, with its ancient tower and manor of the Genoese seigneurs, dominates the Gulf of St. Florent from a rocky bluff.

Photograph by Clifton Adams

IN THE "HIGH TOWN," UNDER THE CITADEL AT CORTE

The centuries-old little houses, built of stone even to the stone shingles, seem solid and strong enough to last for centuries to come.

separating the brown-red rocks of the Calanche from the purple peaks of Cap Senino and Point Scandola, now lies below in all its fascination, with a Genoese tower, long since cracked and ruined, sheltering the tiny harbor at its eastern end (see illustration, page 242).

At the tiny port a pile of half-squared logs awaits shipment. A hog whose chestnut diet has so fattened him that the most ignorant of visitors could not mistake him for a sanglier roots contentedly in the brown earth. A homely girl in a gay dress, washing behind a hut from whose rough chimney curls a bit of smoke, adds a "Home, sweet home," touch to the scene.

To the right, as one looks out to sea, is the almost barren slope above the Calvi road, with the pyramid of Senino beyond; to the left, the maquis toward Piana. Breaking the inverted triangle of sky and water, is the Genoese watch-tower on its rock pedestal—a picture which no artist could confine to canvas. Beauty runs riot with wanton waste.

As I looked at the fine eucalyptus grove beyond the glistening curve of river, my foot hit an old medicine bottle with its label still legible. It had held a fever remedy. In summer this lovely valley mouth is a miasmic morass with a breath as deadly as the drugged roses of the story-book adventuress.

MAKING FLOUR FROM CHESTNUTS

Beside the three-arched bridge, which is the most important structure of Porto and almost its only excuse for being, there is a little water mill, in whose shady courtyard stand the diminutive donkeys which have brought hither chestnuts for the making of flour.

The nuts grow wild, but each family has its own favorite nutting grounds and many of the trees are owned by private individuals. They are dried for a while and then inclosed in a leather sack and slapped on a wooden chopping block with a noise like that made by the laundress who uses the Mark Twain method of trying to break rock with a wet shirt tail. Then they are sifted in an ordinary round sieve sliding back and forth on two highly polished sticks.

The shells are thrown out and the nuts again dried all night in an oven from which the fire and bread have been removed. They are then ready for grinding to a fine sweet flour whose taste is quite pleasing. Yet never in Corsica did I eat bread made from chestnut flour, and it does not bear a good name among the people, as the sweetness of the nut turns sour in the process of making.

"THE HOUSE WHERE COLUMBUS WAS BORN"

There were heavy clouds during our ride to Calvi along the rough and rugged coast, and what should have been a trip of rare beauty lacked the distant views which usually feature it. We passed along the lofty road, which is ever making up its mind to take a spectacular dive, but never has the courage, and so scurries back toward the heart of the land.

When, almost upon it, we turned to face Calvi. The old citadel, "Semper Fidelis" to the Genoese, rose like a casket of old ivory into the cloudy sky. Certainly there are few cities so charmingly situated. The high town looks down from its battlements upon the newer city behind the quay, and the new town turns up its nose at its older neighbor.

Near the entrance to the town is a fine monument which the citizens have erected to their recent dead.

On the north slope of a hill within Calvi's fortress bastions there are some ruined walls which cannot much longer resist the forces of time. The memorial stone has recently fallen from its place above the door and has been removed to a small chapel in the citadel. Only a few figures of rough masonry now clutch desperately at the fame that is so rapidly falling away from a structure at whose ambitious pretensions so many have dared to scoff.

There is nothing equivocal about the inscription: "Here in 1441 was born Christopher Columbus, who through the discovery of the New World gained immortality while Calvi was under Genoese control. He died in Valladolid the 20th of May, 1500."

No one knows where Columbus was born. One of his closest friends, who wrote some memoirs of the navigator, was approached by a man who offered him much gold if he would record the statement that Columbus was born in

Photograph by Clifton Adams

A TUNNELED THOROUGHFARE IN THE CORSICAN CAPITAL

In the overcrowded sections of the larger cities of Corsica are covered passageways through the houses from one winding street to another. This is a passage from the market place at Ajaccio.

Photograph by Maynard Owen Williams

MONARCHS OF THE HEIGHTS

These magnificent specimens would make a sportsman sigh for his rifle until he learned that they are domestic sheep of the Corsican highlands.

Photograph by Clifton Adams

THE CAPO ALLA VETTA TOWERS HIGH ABOVE THE BRIDGE AT THE JUNCTION OF THE LONGA AND PORTO RIVERS, BETWEEN OTA AND EVISA

The narrow trail on the mountain side was made by donkeys, which transport Evisa's wood supply from the heights.

Photograph by Clifton Adams

EVENING ON THE GULF OF PORTO

At the estuary of the river is the little forest of Porto and the tiny port. An ancient Genoese watch tower stands guard over the harbor. In the distance is the rugged Cap Senino.

Photograph by Clifton Adams

WHERE HOUSEWIVES CAN RENT SET TUBS FOR FOUR SOUS A DAY

Running water is supplied at these municipal laundries in the larger cities of Corsica, and there is a busy group of women on hand every week day.

Photograph by Maynard Owen Williams

LAUNDRY GIRLS AT THE MUNICIPAL WASHING PLACE NEAR THE AJACCIO CATHEDRAL

Heavy woolen socks and shoes with wooden soles are the customary equipment for this task, but the girl with the negligee footwear had an engagement at the town hall as soon as she completed her work, and when she appeared in boulevard regalia she was a captivating Corsican belle.

Photograph by Maynard Owen Williams

THE MORNING AFTER A SNOW IN BICCHISANO

The Petreto-Bicchisano combination of towns, inseparably wedded as so many Corsican villages are, lies on the road from Ajaccio southward to Sartène among some of the most beautiful of the Corsican hills. The twin towns nestle in a ring of shady trees with the Ben-Nevis-like Mount San Pietro towering above them.

Photograph by Maynard Owen Williams

AN OLD HOUSE IN FRONT OF THE CHURCH OF SAINTE MARIE MAJEURE, BONIFACIO

Sainte Marie Majeure, the chief religious edifice of Bonifacio, was built by the Pisans. Long ago the senate met in its large vestibule to discuss public affairs. The stairway in the background leads to the city hall.

Photograph by Clifton Adams

A YOUNG MILK MERCHANT OF BONIFACIO BEFORE THE "HOUSE OF THE KING"

This building with the elaborate bas-relief above the door is supposed to have been occupied by the Emperor Charles V for a time upon his return from an unsuccessful expedition against the Saracens in Algeria in 1541.

Photograph by Clifton Adams

IN THE IMMENSE SEA GROTTO OF THE SDRAGONATA NEAR BONIFACIO

Smaller grottoes open into the walls and sometimes rocks fall from the jagged hole in the ceiling. On bright days a yellow-green twilight reigns in this "Throne Room of Neptune" (see text, page 312).

Photograph by Maynard Owen Williams

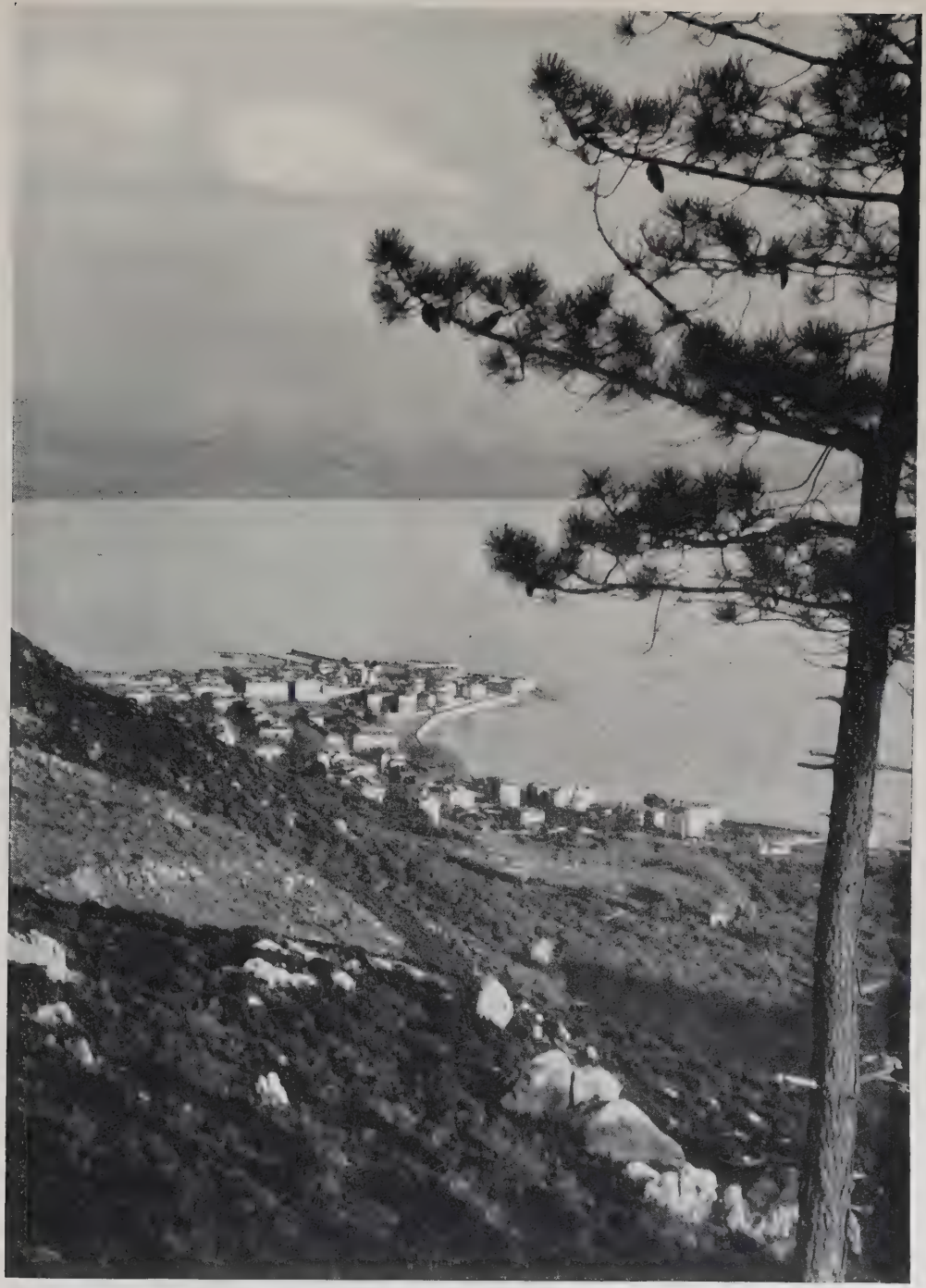
ONE OF THE OVERHANGING CLIFFS UPON WHICH BONIFACIO STANDS

This, the Col de Saint Roch, is the narrowest part of the peninsula upon which the town is built. The Bonifacio roads are blinding white and when heavy winds prevail, the soft white limestone dust penetrates every crevice of the buildings.

Photograph by Clifton Adams

SCHOONERS IN THE HARBOR OF AJACCIO

While one ship is at the dock another waits to take on a cargo of short timber for Syracuse in Sicily.



Photograph by Maynard Owen Williams

AJACCIO FROM THE HEIGHTS OF SALARIO

This hill has furnished much of the stone from which many of the well-built houses of the town are made.

Photograph by Maynard Owen Williams

A CORSICAN SHEPHERD ON THE HILL BEHIND AJACCIO

"He knows that time is money, and has no desire to hoard it or multiply it" (see text page 235). The people of the island are slow-moving and are secondary in interest to their environment.

Photograph by Maynard Owen Williams

A COMPANION OF THE OPEN ROAD BETWEEN GROSETTO AND BICCHISANO

The romance of the Corsican used to be his love for revenge, his use of the vendetta to cancel an actual or fancied wrong, but that characteristic is largely of the past.

Photograph by Clifton Adams

A WAYSIDE CALVARY

Nine-tenths of the Corsicans adhere to the Roman Catholic faith. Two women of the mountain village of Zilia have stopped for a morning chat under the cross.

Genoa. Publicity men are evidently not entirely modern inventions. But the historian remained true to his calling:

"How can I say so?" naively asked this man, "when Columbus never told me where he was born and I don't know?"

So Calvi, as jealous of its honor in giving birth to Columbus as Ajaccio is heedless of the honor of Napoleon's nativity, is unable to prove that the particular bright star of the numerous Colombo family, which was Genoese and whose descendants live till this day in Calvi, was born not in Genoa itself, but in the city which Giovanninello de Loreto had founded two centuries before.

Careless Ajaccio will soon have a third statue to the soldier who has its loyalty but not its love. Jealous Calvi has allowed the alleged house of the great discoverer to fall into utter ruin while it has pushed its verbal claims.

If Calvi ever proves its case, it will have an elaborate bit of reconstruction work to do which may be as difficult as patching up its documentary claims, for the boys of Calvi use the stones from the house of Christopher Columbus in their various games. No savant has made more sport of Calvi's claims than the boys of Calvi are making of Columbus' house.

Calvi is linked to America by Columbus and the Boulevard President Wilson, which is the city's main street, and to England because there Nelson conveniently lost an eye during the siege of 1794—an event which led to great results at Copenhagen when the sightless socket saw victory where the good eye refused to read retreat.

THE PORTS FOR CORSICA'S RICHEST GARDEN

Between Calvi and Île Rousse, by the sea road, there is the interesting little town of Algajola, proud of its quarries. The streams of Paris taxicabs entering and leaving the Rue de la Paix between the Place de la Concorde and the Opéra are separated by a pedestal of Algajola granite upon which the Vendôme Column stands.

Île Rousse is the scaffold erected by Paoli, on which he hoped to hang Calvi, whose loyalty to Genoa was no great merit in Corsican eyes. To-day it owes much of its importance to the olive trees that the Genoese forced the Corsicans of the Balagne to plant; for Île Rousse, spread out on a little hump of land inside the red islands, shares with Calvi the responsibility of being the market port of Corsica's richest garden.

My first trip to Île Rousse was by motor from Piana. Sunrise found me fleeing the nightmare of the Calanche. Sunset found me dreaming in the lotus land of La Balagne.

OUR FRUIT-CAKE CITRONS COME FROM ÎLE ROUSSE

The olive gives richness to the widespread valley north of Belgodère. Many a continental olive-oil firm has made an enviable reputation with the aid of this Corsican grove. But the citron is the most distinctive export of Île Rousse. The pier just before Christmas was almost entirely occupied by huge casks full of citrons in sea water, all labeled for New York (see illustration, page 273).

Out to sea there are the small islands of a reddish stone which give the port its name; but they have been so bound to the mainland by a causeway that my chauffeur insisted that they formed a peninsula.

Île Rousse's market, with its roof supported by classic columns, is a trifling affair, as markets are bound to be where every man is his own gardener. A much busier place is a smaller and dirty temple to cleanliness, the town laundry, where women buffet wet fabrics far into the night.

The colonnaded market is also the town forum, and the affairs of the universe are settled there from day to day, for Île Rousse is no backwoods place. It is one of the Corsican ports nearest to the mainland of France and it reads newspapers. I could not secure a hotel room until I had satisfied my genial host as to the reception which Clemenceau was having in America.

Between Île Rousse and St. Florent, one passes through a corner of paradise and a touch of hell. The Balagne, which pushes a fertile corner down to the sea, is the cornucopia of Corsica, with citrons and oranges and figs and olives pouring forth to feed the world: the desert of Agriates does not contain a single village, and the few shepherds who traverse its barren slopes and rocky hollows are Bedouins without a home.

Photograph by Maynard Owen Williams

THE LAST MEMBER OF THE PAOLI FAMILY AT MOROSAGLIA

She is deaf and old, but she keeps watch over the house and the ashes of the Corsican patriot who drove the Genoese from the island. Like his fellow-countryman, Napoleon, the last days of Paoli were spent in exile and on British soil, but not as a prisoner.

But in all of Corsica, even on the eastern plain, there is no region so rich in game as is this desert. It is probable that the wild animals and birds import their own rations; but there they live to turn an arid waste into a sportsman's paradise.

Naturally, the highway seeks out, as highways do, the most fertile and thickly settled regions, and at Casta there is a fertile oasis so intriguing that unless one looks more to the north he will be deceived as to the deadly barrenness of the place. In winter, during such a rainy time as I experienced on my first ride over the Col de Lavezzo, enough transient verdure tints the ugly slopes to link them to the greener countryside; but in summer the desert of Agriates doffs its diaphanous veil and shows its ugly face to the suffering traveler whose fate it is to pass that way.

One coasts down the barren eastern slope to that picturesque gulf so favored by Napoleon and so ignored by commerce, beside which stands the town of St. Florent. This seaside fishing village has 896 inhabitants, of whom the masculine minority drape the idle quay and the feminine portion drape every shrub at the entrance to the town with laundry, which they wash in a narrow creek between tall poplars such as Corot would have loved to paint.

SKIRTING CAP CORSE

Before circling Cap Corse to Bastia, it is well to understand that this appendage is quite different from the land to which it is attached. The mountain range has driven the Cap Corsans to sea, so that they rank second only to the Bretons in the navy and marine of France. When the *Liberté* went down in Toulon harbor, half of Cap Corse was in mourning.

The same thrust of mountains that has sent the people of Lebanon to North America has driven the people from Cap Corse to Central and South America, and even those who have remained have an air of industry which is un-Corsican.

In Cap Corse the vendetta has never been known. When Prosper Mérimée lifted his best novel out of the Colomba country, behind Propriano, at the other

end of Corsica, and located it in Pietranera, a peaceful suburb of Bastia, he sacrificed the fidelity of his art to a consideration for humanity. He could describe a vendetta in Cap Corse without giving birth to one. "Colomba" was played in Bastia, and received in the same manner there that "The Virginian" was received in Boston.

On the west the mountains overhang the sea. The Corniche Road here is far more impressive than the more famous one on which the winter resorts of the Riviera are strung. It climbs far above the sea and walks a tight rope which is stretched against a towering wall and snubbed around water-level bridges. It rushes down to tiny triangular valleys at the mouths of mountain streams. It winds and turns in torment and in fear of overhanging cliffs which from time to time drop repair materials to the roadbed. It holds the No Man's Land between the forces of mountain and wave and is a constant spectator to their endless battle.

Photograph by Maynard Owen Williams

IN THE SHADOW OF THE STATUE OF NAPOLEON IN THE PLACE ST. NICOLAS: BASTIA

THE HEROIC LEGEND OF NONZA

From Nonza to Centuri the towns are anchored to the sloping mountain wall by ancient towers whose bases rest on rock. Of all these pleasant villages, Nonza is the most picturesque. The approach from the south does not reveal its spectacular character. The houses mount steeply enough from the sea and the tower of Nonza is more isolated on its point of rock than most; but from this side the base of the town is a steep hill rather than a precipice.

Not so on the north. There is a sheer drop of 500 feet from the ruined Genoese tower to the waves which churn so angrily below. The houses beside the road behind the topmost peak are not set on a hill; they are fastened to it. A steep path, which is a stairway for much of its length, descends to the water's edge, and up it there is always moving a conveyor belt of women and donkeys carrying clean water to the top. Gravity is used in the reverse direction. From the unkempt chins of the overhanging houses dirty water drools downward to the sea. It is an unbelievable town in an impossible setting.

Photograph by Maynard Owen Williams

THE OLD PORT AT BASTIA, WITH THE CHURCH OF ST. JOHN THE BAPTIST TO THE RIGHT

When approached from the sea instead of by rail from Ajaccio, Bastia presents an imposing appearance. Its lofty houses encircling the water front suggest a vast amphitheater. The chief exports of this port, the commercial metropolis of Corsica, are chestnut extract, used in tanning, citrons, oranges, early vegetables, and fish—especially sardines. In the days of Genoese ascendency in Corsica, Bastia was the principal stronghold in the northern half of the island and the place of residence of the governor.

Nonza has frequently suffered siege and with Bonifacio it shares a story which is too good to be true. This is the original and only place where, in response to a promise to spare the garrison if it would evacuate, a solitary man, Jacques Casella, laden down with guns, stumbled forth and said to the astounded besiegers, "I'm it." The enemy decorated him, and on that precipitous rock, to which not another material substance could be attached, this legend was hung.

Friends told me that I should see Canari, and on the kilometer stones along the road I watched carefully for the name. Having passed through Sagone without knowing it, I did not want to let another town creep by unnoticed. The hillsides were strewn with villages, some above and some below the road. The chocolate and crescent of Île Rousse had left vacancy in my thoughts; so I passed one charming village after another with the intention of letting Canari do for the lot.

At a small group of houses beside the road my chauffeur, to whom hunger had doubtless become as insistent as with me, stopped the car.

"This is Marinca," he said.

I had never heard of Marinca. We rolled on, rounded one hill after another, and rolled down to the little hotel, flat against a square old tower, where he had ordered lunch. I saw the name and realized that we were in that fair haven of epicures, Pino.

"But we missed Canari," I protested to my chauffeur.

"Marinca, c'est Canari," was the reply. For the second time on this rapid first survey of the land I had passed through a town which I had imagined I wanted to see, but without knowing it.

In Corsica a group of villages takes its name from its principal hamlet. In some cases, as at Bastelica, there is no village bearing the name by which the group is known. One takes an autobus to Bastelica and finds that Sampiero's house is in Dominicacci. One climbs to Morosaglia to enter the memorial chapel of Paoli and finds that the ashes of the "father of his country" lie in Stretta. So it was that I passed through Marinca looking for Canari.

There was little cause for resentment on my part, for the lunch at Pino, late as it was when we arrived, was enough to make one forget every calamity. In all Corsica, there is no place where one can eat as well as in Pino, where a little hotel proves that Corsican inns can be attractive, and that Corsican innkeepers can regard their guests as something more than disturbing elements.

A CORSICAN INN THAT VIOLATES ALL THE ISLAND'S RULES

The good hostess came out to meet us, clean of apron and beaming of face.

"Did you get my telegram?" I asked. It was the first written French I had ever entrusted to anyone except an unappreciative professor and I was almost surprised to discover that it had worked.

"Would you like to wash your hands?" then asked my new-found friend. Luckily, my experience with Corsican inns and their keepers was so meager then that I did not drop dead of surprise. Wash my hands? Who ever heard of a Corsican innkeeper suggesting such a thing? But while I did so, I noted how neat was the chamber, and determined, even before I had had luncheon, that Pino should see me again.

For weeks afterward, from hotel and inn, I looked back on that lunch in Pino with longing. To savor it, picture a large upper room, as tidy as a guest-room in an American farmhouse, with a red-and-white tablecloth, spotlessly clean and, with the creases in it left by the iron looking like a clothing advertisement. There was a fire at my back and in front of me a pile of plates reaching almost to my chin. On top of them was a heavy linen napkin, white as sun could make it and large enough for a dozen.

I had scarcely time to notice this much when the parade of viands began. A soft-boiled egg, which I am sure had never had a chance to cool, was followed by such a bouillabaisse as Marseille never knew. Then came two delicious fish. My hostess beamed with pride when she assured me that this was the fish of the country.

A crisp pork chop and a nice little steak, with such French-fried potatoes as honored the country from which they took their name, were next on the table; but there was no bill of fare and I had no

Photograph by Maynard Owen Williams

FRONT PORCH PERSIFLAGE IN PIEDICROCE

way of knowing how far I was on the road to epicurean paradise.

A woodcock with a chest development like a gymnast next appeared, followed at a decent interval by some white beans, so tasty that even a Bostonian would have forgotten his proper civic pride on eating them; then some cheese and fruit, a plate piled high with mandarins, which seemed anxious to shed their colorful coats to prove how good they were at heart, with figs and walnuts and raisins.

I was so generous with my tip that my lunch, together with that of my chauffeur, who had the same meal, but with wine and coffee in addition, cost $1.25.

On my return to Pino, weeks later, I was so disloyal to my first hostess as to go to the hotel of her rival; but I was not without my reasons, nor was I sorry. The lunch was equally good and my wants were looked after by a retired sailor, who was decorated and rewarded by three separate agencies because while an officer on a ship in the China seas he saved the lives of three Annamites at great risk of his own.

Pino is only one of a half dozen charming west coast villages, with a fine church, some well-kept graveyards, several old towers for watch and refuge, and a general air of cleanliness and cheer. But when some unusual banquet causes me to run back over the feasts that I have enjoyed, I shall think of Pino and the lunches I have eaten there.

A WINTER SCENE IN A CORSICAN INN

It was in Pino that hostess and host seated me at their abounding tables with my back to a warming blaze. Pino points the paradox of Corsican inns, for usually a winter lunch in a Corsican inn, however good it be, is a severe ordeal.

One enters a narrow, plain room, near the back of which is its main attraction, a smoldering fire of bruyère roots, gnarly pieces with unsound hearts, and hence worthless for pipe manufacture. Around this fire, which lacks the crackle and glow of pine or birch, are the common folk whom lunch time or night has overtaken on the road.

The cart peddler has parked his donkey in some kennel and stacked away his display of piece goods in his small chamber. Now he gives his knotty hands to

the luxury of the warmth, while the fire breaks into flame in response to spirited bellowsings by a pretty woman who seems to be half guest and half friend of the ample-bodied hostess.

From behind, there is a soft halo on the silvery hair of the peddler thus come to shelter, and there is a bright spot where the firelight falls on the school-book which the son of the hostess studies, like some Corsican Lincoln.

On a table near the center of the outer wall, between the dying light on the snow outside the open door and the glow of the fireplace, a meat grinder and sausage stuffer is being turned by the man of the place, who has evidently been called back to this task from the many-pathed maquis, with its game.

Photograph by Maynard Owen Williams

THE WAY WATER IS CARRIED IN GHISONI MAKES FOR GRACE AND SURENESS OF STEP

Altogether a homy little group, and one wishes that his tongue were more facile, his ear more cunning. But his station and nationality are more against him than his meager knowledge of the language.

The hostess, wiping the sausage grease from her hands, takes down a green glass lamp from the mantle, and the heart of the honored traveler sinks. He knows that he is condemned to solitary shiverings in the upper room, whose size and cheerlessness are alike Elizabethan.

Up he tramps behind madame and waits with hands in pockets for each course, which comes clumping flat-footed up the dark stairs to arrive before him sadly chilled.

Time and again I hinted that I would like to be allowed to be happy with the herd rather than suffer solitary grandeur behind a monument of cold crockery which marked the burial place of true comfort; but your good-hearted Corsican hostess will no more allow such *lèse-majesté* than a pretty Corsican girl will allow one to take her picture on a week day. The honorable foreigner is superior to modest cheer and only the best room and the best dress are fit for him!

So he suffers in silence and carries in his mind pictures far more attractive than any Sabbath camera can catch, since the Corsican women, seldom pretty but often attractive, do not photograph well.

Not that they feel that way about it. As long as a portrait shows the photo-miniature brooch, the cheap lace, and the stiffly tied ribbon, it is worthy of enlarge-

Photograph by Maynard Owen Williams

CHARGING THE FOOTWARMERS OF A CORSICAN TRAIN AT GHISONACCIA, ON THE EAST COAST PLAIN

ment and a hanging in the best room, so that the visitor, in spite of his ague, takes interest in the portrait gallery, baronial in style, which shows the rather attractive hostess as a stilted young thing with a wooden face, and the turner of the sausage grinder as a kaiserlike warrior with bristling moustache and many medals.

BOSWELL'S GIFT TO CORSICA

From Pino to Centuri the campanile is the thing. There are, to be sure, towers of refuge and defense, round and square, some falling to decay, some glistening with new plaster; but always, above the inconspicuous houses and above the Genoese towers themselves, rise the steeples of churches or their campaniles.

In Corsica as in Russia, the church is the most conspicuous feature in the urban view of country landscape; but it is not the opulent domes, like upturned beets or olive-colored with verdigris, that one sees in Corsica. The church is a mere appendage to its spire, and where the campanile is detached, it is the bell tower rather than the house of worship which dominates the scene.

Morsiglia has its staircase of old towers and its tiny terraced vineyards, each sheltered by the hedge erected of heather withes to keep off the fierce winds and to reflect the heat. Centuri is an opulent group of hamlets and isolated homes. I spent little time in the upper parts, but descended to the tiny port where Boswell landed on his pilgrimage of hero worship to the headquarters of Paoli.

What an impressionistic propagandist he was and how much Corsica owes to him! Boswell, Rousseau, Lord Byron, and Mérimée have done for Corsica what it has never been able to do for itself. These enthusiasts planted romance in a land where to shoot a man in the back and without warning was the accepted style.

Like Napoleon, the best-known Corsicans have won renown as Frenchmen. Corsica is the nursery for French admin-

Photograph by Maynard Owen Williams

A SHEPHERD AND HIS SON IN THE INZECCA DEFILE

This picturesque mountain pass, which is a half mile long, lies on the road from Ghisonaccia to Ghisoni (see map, page 224).

istrators, and wherever there is a colonial task too difficult or too exacting for the continental French, a Corsican is put in charge and handles the situation well.

Yet this modern Corsican, whose romance has nothing of bravado, of cruelty, or of melodrama in it, but much of painstaking loyalty and skill, is lost sight of because a British writer, to whom every contact with the famous was a mental cocktail, made Paoli and Corsica the vogue when friends were needed and sympathizers were few.

This enthusiastic journalist, whose Corsican journal is little known to-day, did for Corsica what Lord Byron did for Greece—gave it a vogue at a time when liberty was on every tongue, but when this shuttlecock of petty conquests was rattling back and forth from French and Genoese battledores, with every possibility that it would fall between the two into a sea of oblivion.

Turning the end of Cap Corse to come down the home stretch from Macinaggio to Bastia, the road parallels the sea, climbing now and then to cut corners or retreating from the waves on a shelving beach. It makes no attempt to reach the villages on the heights. It feels that its duty is done if it serves the comparatively insignificant "marines" or ports of the real villages.

In the old days, before the coast-circling road was finished, a Cap Corsan did not shinny around precipices to call on a friend in a neighboring commune. He made the sea his highway, and although land communication along the east coast or from hollow to hollow was far simpler than on the more savage west, a boat was easier to use than a wheeled vehicle.

Even to-day there is no *highway* on the east coast. To go from one highland village to another, one must descend to the sea. The autobus which circles the cape might as well be a motorboat, as far as serving the upper villages of the east coast is concerned. The road, which passes through no village but Erbalunga, has side spurs of from two to five miles which climb to the towns. One of these spurs shoots almost straight up the valley from Santa Severa to Luri, and then, with

Photograph by Maynard Owen Williams

A COUNTRY ROAD NEAR PORTO VECCHIO

anguished writhings, hurdles the pass below the legendary Tower of Seneca to switchback down to Pino.

I was little impressed by the villages of the east coast, perhaps because I never reached them. Neither chauffeur would attempt the bad routes which join them to the seaside highway. Former writers had spoken of the palaces erected by the "Américains," the Cap Corsans who had made their pile in Central and South America and had come home to roost on pretty perches which their foreign funds enabled them to fasten to beloved hills.

I met several of these returned wanderers, but they were never in their homes. They were either on their way to or from a steamer connecting their native land with their adopted homes.

BASTIA, THE METROPOLIS OF CORSICA

Bastia is the hustling metropolis of Corsica. Its Syndicat d'Initiative has so described it, and the true Bastiaise in leaving his café to go to his club shoots his cuffs, tweaks his hat, and puts on a very busy air. The conscience of progress has got under the skin of Bastia, so that it does its loafing, not with Ajaccian abandon, but with a touch of shame.

Bastia has almost become provincial. Long since it surged ahead of the rest of Corsica. Its women differ from those elsewhere in that they have some means of supporting their stockings and they dress better. Its opera is crowded; its stores have something to sell and they sell it.

I visited a dozen little bookstores in Ajaccio to buy Daudet's "Lettres de Mon Moulin," and always found that I was ten days ahead of time, even on the second visit after a fortnight's excursion. I asked for it at the first bookstore I noticed in Bastia. It dropped, like mercy and the gentle rain, from some hiding place.

"There it is," said the pretty clerk with a shortness that made me homesick for America. "Have you read 'La Garçonne'?" Possibly she thought that the book she sold me was by Léon Daudet instead of Alphonse, but she had it and at once. Commerce does not stutter in Bastia.

Like Hongkong, Bastia was once a tiny fishing village, but in 1380 a Genoese governor constructed a fort there from which he could wage war on the Corsicans of the interior. From the bastions of his fort the city took its name. The seat of government was moved up from beside the pool of Biguglia to the site which was, until Madame Letizia Bonaparte had it moved to Ajaccio, the capital of Corsica. Now it is the residence of the military governor.

THE BEAUTIES OF BASTIA

Genoa, which bequeathed to the Balagne its best variety of olives, gave Bastia its skyscraping slums. The Genoese by instinct leans his house against a hill, and then enters through roof or cellar, according to his convenience.

The older parts of Bastia are made up of houses so many stories in height that one dare not mention the number; and the streets that cut through this mass of masonry, like mole trails or cracks in the earth, are so narrow that in places one can touch both sides of them. There are steep stairway streets that lead down to the harbor, and the Ruelle du Guadello is as deep as it is long.

These towering buildings and narrow streets give to the older parts of Bastia what seems rare charm. If the traveler found the same conditions at home, he would appeal to the municipal council against such insanitary surroundings.

The changing lights of day and night bathe those smelly structures in a glow that is mystic in its effect. Old reds and yellows, with spots of green and blue-black roofs, all are reflected as behind a gossamer veil in the sparkling waters of the harbor.

My friend took me up into the park, where we could look down between the umbrella pines on all this disordered splendor. He took me through the market squares, where the smell killed sight and sound until, framed in the arch of some ancient building, I could look out upon the blue of that sea that bathes the slopes of Elba.

His eyes were injured by poison gas. Sometimes I could not see just the beauty that he glimpsed. His impaired vision was being kind to him in the city which he loved, and from time to time, he gripped my arm till it hurt, seeking to express the spell which held him there. A score of charming vistas he revealed to me, but perhaps the finest of them all was a glimpse into the heart of a true Corsican, who loves his native land.

JEALOUSY BETWEEN RIVAL PORTS

Bastia is no doubt a little conscious of its importance to Corsica, and it views with a certain touch of jealousy the trifling successes of the other ports. Lacking though they be in the narrow provincialism that distinguishes some of the inland districts, the ports of Corsica have their own little heartburnings. When the report went around that there would be a new and larger steamer put on the run between Bastia and Nice, Ajaccio promptly rose in arms against this show of favoritism, with such effect that the managers wrote an open letter assuring the people of the sleepy capital that their city would be given equal service.

What seems a petty thing to the outsider is highly important to Corsica. When I was in Bastia on my first visit, it had become known that the *Mauretania* was to stop for a day at Ajaccio on its Mediterranean cruise, with hundreds of American millionaires on board. A tourist ship never cruises the Mediterranean without millionaires. Any one will tell you that.

Photograph by Maynard Owen Williams

THE HARBOR OF PORTO VECCHIO AND THE SALT FIELDS BEYOND FROM THE CITY WALLS

The broad harbor is so shallow that goods must be brought to visiting steamer in lighters.

"Why should such a steamer stop at Ajaccio instead of Bastia?" asked one who seemed to blame me for this slight to his fair city. "Ajaccio is only a lazy town. Bastia is half again as large and three times as busy. A fine idea these hustling Americans (millionaire American tourists are always "hustling") will have of Corsica if they see only Ajaccio. But it was the same last year. The *George Washington* stopped at Ajaccio and gave us the go-by. Something ought to be done about it."

AJACCIO-BASTIA RAILWAY CAN CARRY SIX FIRST-CLASS PASSENGERS AT A TIME

It is deplorable that tourist parties should stop only at one of Corsica's ports, for the railway trip between the capital and the metropolis is one of rare beauty and extreme variety, offering a taste of almost every feature of Corsican life and scenery. There are few good steamers which could not round the island and reach Bastia from Ajaccio while the little train is puffing its way through the backbone of the country and down on the other side.

But even if all the first-class rolling stock in Corsica were mobilized for the occasion, not a very large party could cross the island at once. Recently the railway has acquired two excellent coaches, which are the pride of the administration. In each one there is a spacious parlor, which should have a sprig of wax flowers under a bell jar and a "tidy" on each of the luxurious seats, for I have never seen this special compartment open.

A party of us rode second class instead of first, because only six first-class passengers can be accommodated in this *wagon de luxe*. But all that time the spacious special compartment was locked and its curtain drawn. Such a "best room" is a fine talking point, and would also be a very good thing to use. But, like the Emperor's rooms, which turn the Tokyo station into two noncommunicating parts, the special compartments of the Corsican railways serve no good purpose, in spite of the fact that they are hoisted over the mountains and back every day—so much dead weight.

The ride down the east coast is mo-

Photographs by Maynard Owen Williams

A MOUND OF SALT AT PORTO VECCHIO

Porto Vecchio was the ancient Portus Syracusanus of the Genoese. The finest cork-oak forests in Corsica, which are near the city, furnish the port with its principal commodity.

notonous compared with the abounding variety which one expects in Corsica. After a chauffeur has hurdled the hills along the west coast or across the island, he can well regard his profession as a nonessential occupation when he strikes the arrow-flight roads on the eastern plain. Yet in winter the ride is not without its pleasant surprises, since from here one gets a good view of an entire range of snow-clad hills.

THE CORSICAN OF THE PLAINS HAS RETREATED BEFORE THE MOSQUITO

At Casamozza, railway and road dip into the hills to follow the Golo up to the heart of the communication system at Ponte Leccia. Here and at Barchetta and Folelli are gallic acid factories for the production of tanning solutions from chestnut wood. At Barchetta there is a new factory, where for the first time paper is to be made from the wood pulp of the chestnut tree. From Casamozza south to Prunete and Cervione our road passes to the east of the chestnut country, the Castagniccia.

We do not turn into the heart of the land but parallel the low-lying coast until we pass the lighthouse of Alistro. Passing the ancient site of Aleria, near the mouth of the Tavignano, we spent the night at the estate of Casabianda, one of the few expanses of the east coast which is not surrendered to the mosquito.

Before the mosquito of the eastern plain the Corsican has retreated to the hills, leaving the most fertile expanse in the island practically untilled. Just as in the days of the Saracens and the Barbary corsairs, there were large cities of refuge built in the hills, so to-day the narrow plains are depopulated in summer on account of the fever and the heat.

THERE ARE TWO CORSICAS

As in the Lebanon, the terraced hillsides are eloquent of hard toil for a sometimes inadequate return; but close at hand are fertile plains almost destitute of life, because the cancer of fatalism has eaten for centuries at the heart of Corsican valor. Fever and heat have by their insistence conquered spots upon which no foreign invader has ever planted his standard.

Photograph by Clifton Adams

DELIVERING THE MORNING MAIL AT THE HOTEL DE VILLE, UNDER THE BELL AND FLAG OF THE CITY OF BONIFACIO

In the old city, around the citadel of Bonifacio, the Rue Sainte Croix is crossed at intervals by stone arches from the Church of Sainte Marie Majeure.

Photograph by Clifton Adams

THE ANCIENT PORTE AND DRAWBRIDGE IN THE WALLS OF THE CITADEL OF BONIFACIO

The wheels to which chains are attached roll down the incline, thus drawing up the bridge and closing the gate. This porte was for centuries the only means of entrance to and exit from the fortified city, and dates from the year 828.

There are really two Corsicas—the coastal plain, which is the product of Genoese, Pisan, or Roman enterprise and the island's necessity for contacts with the outside world, and the more or less self-contained Corsica of the highlands, which, instead of extending its dominion of arable plain, has shrunk back to the rolling hills and rugged mountains, building new homes on the heights and allowing once habitable dwellings on the plain to show roofless interiors to the hot sky.

Somewhere in the Corsican character there is that lack of enterprise, of coöperation, and of common planning that banishes fever and reclaims swamps. Assyria and Babylonia rose above engineering difficulties such as those to which Corsica has succumbed or in the face of which she is showing a lamentable lack of resourcefulness.

The Corsican has denounced France for not finishing the east coast railway to Bonifacio, but ignores the fact that a

Photograph by Clifton Adams

CONSTANCE LIVES IN ONE OF THE FIFTEENTH CENTURY HOUSES OVERLOOKING THE SEA AT BONIFACIO

The hot summer sun and the glare from the chalky soil are responsible for her freckles.

railway must live off the land it traverses as well as the ports it serves; and that if fever rules over unplowed fields, the stretching of two tiny rails a meter apart along its length will not rescue a plain from disease or poverty.

A bale of mosquito netting would have saved many a Corsican life. The draining of the miasmic swamps would enable thousands of acres to become what they were in the days of the Antonines, who rescued them from just such conditions as now prevail, when from Aleria were shipped great cargoes of grain to feed Imperial Rome.

The east coast was and is Corsica's Camargue.* But the Corsican makes less use of this rich region than the herder of the Camargue makes of his less fertile plains.

EVIDENCES THAT CORSICA MAY BE AWAKENING

The planting of eucalyptus trees has beautified the monotonous landscape and provided incubators for the mosquitoes; but the silted-up swamps have not been dried up by these thirsty trees, and the shoreline of the real Corsica stretches along an imaginary level seven hundred feet above the sea.

There lie the fertile but unplowed lands before the very eyes of the impoverished people, thousands of whom would die of famine if a blight were to attack the chestnut groves.

Were the plain crowded with enemies, Corsican valor would no more be lacking to-day than it was in the past, when scores of stories of bravery now appropriated by other peoples had their actual birth in Corsican character.

But the east plain of Corsica, the paradise valley of the Sagone, the Campo dell' Oro, and the level expanse behind St. Florent speak as loudly as does the rusted French excavation machinery in the jungle of Panama of the triumph of malaria.

There is no climate too arduous, no sanitary or engineering problem too difficult, to stop the progress of the organized world. Railways will cross arid deserts to reach rich mines; the primitive jungle of the tropics will fall before the need for bananas, rubber, or coffee; nor heat, nor cold, nor famine can save the oil resources of the earth from those who need them.

But meanwhile, in regions too poor to attract big operations, deforestation is stripping the rocks of their blanket of earth, erosion is carrying off the fertile elements of the soil, rivers are silting up and making swamps where fever breeds and famine threatens. Such a region is the east coast of Corsica.

Beside the highroad south of Bastia there is an open trench in which water pipes are being laid, so that the largest city in the island can have more pure mountain water. There are other schemes, too, in progress for making the fertile east as rich as the rocky west, and the tide may have set in again toward a new prosperity.

The domain of Casabianda, a great estate of about 5,000 acres, is now operated by the Department of Roads and Bridges. Started as a great dream of salvaging the east coast, it fell into disuse some years ago, its de luxe buildings, its towering silos, its ample stables, sheepfolds, and pigsties eloquent of the tragedy of failure. But recently these once-abandoned buildings were again opened up, and the flocks and herds of Casabianda were the best I saw in Corsica. The man who acted as my guide says that he lives there all the year round, and although he has some fever, he is able to keep on with his work.

Back in the hills there are posters in every restaurant asking the people, as a patriotic duty, to eat chestnuts and other native food products, so that the gold of France need not be sent abroad to buy grain. It would seem that Casabianda is well fitted for agricultural success, in case fever can be banished from the plain behind the salt marshes of Lake Diana and Lake Sale.

AN ISLAND OF SHELLS, MONUMENT TO ANCIENT ROME'S OYSTER FEASTS

These shallow lakes, or étangs, are not mucky swamps overhung with underbrush, but wide-open expanses of water, in whose appearance there is nothing ominous. The husband of the keeper of the guest house accompanied me to the Pool of Diana, taking real pleasure in riding

* See "The Camargue, Cowboy Country of Southern France," by Dr. André Vialles, in THE GEOGRAPHIC for July, 1922.

Photograph by Maynard Owen Williams

PILES OF CORK-OAK BARK NEATLY TRIMMED, READY FOR BALING: BONIFACIO

in an automobile past the shepherds connected with the domain, who had to turn aside their "fleecy fools" to let us pass.

I wanted to see the island of oyster shells which is said to date from the time when Corsica furnished Aleria oysters as the prime delicacies of the Roman feast. Oysters are still exported from here, but a more important product, especially just before the Christmas holidays, is the eels, which are sent alive to Nice and Naples, and are to the holiday feast what cranberry sauce is to our Thanksgiving and plum pudding to an English yuletide.

South of Casabianda the east coast railway emerges from the maquis to come to a stop at Ghisonaccia, where the motor bus takes up the work which the train drops and carries the mail and passengers to Bonifacio.

The road drives straight at La Solenzara, with a wonderful panorama of snow mountains on the west; but at this little village, near the mouth of the Solenzara River, it begins to curve and wind as though it were a section of the west-coast road lost amid unfamiliar scenes. The plain has come to an end. The mountains of Corsica here push their way to the sea, and one rounds a Genoese tower that could occupy a similar position at any one of a score of places on the opposite side of the island.

IN THE CORK COUNTRY

From there one turns inland and invades the cork-oak country, which furnishes most of the trade for Porto Vecchio and Bonifacio.

Porto Vecchio is picturesque enough, especially from the sea, for it occupies a slight eminence to which its own battlemented walls add just the proper touch; but life there is a dreary thing. For the old men, there is the sun and the front of the church, but for the young there seems to be nothing. The boys do not even kick a football. The girls don't bound rubber balls as they do elsewhere in Corsica.

After a wild night ride I reached Bonifacio, where I found a warm greeting because Clifton Adams had paved the way a year and a half before.

Bonifacio occupies a position which surely deserves the overworked adjective "unique." If the travelers who thread the narrow straits on steamers bound for

Photograph by Clifton Adams

BOYS AND DONKEYS OF BONIFACIO

Corse children know all there is to know about mules and burros, for there usually is one such hard-working pet in every family.

the mystic East could know at what they were looking as they file past the stratified cliffs, at least some of them would drop overboard and swim ashore, for Bonifacio is as unusual as any place one is likely to meet on a world tour.

The narrow peninsula and the even narrower harbor fit together like two hands tightly gripped in what young boys playing crack-the-whip used to call "sailor fashion." The restless waters are ever eating away at the land and the overhanging cliffs are suspended like a Damoclean sword above the water, as though each were trying to make this strange mortise joint either land or sea. The sea has sunk its double-barbed hook of harbor deep into the land.

One rolls down from Ajaccio or Bastia to the harbor of Bonifacio through a winding fissure in the limestone plateau, from which it is impossible to see the city until it bursts upon the view above the prosaic roofs of the naval quay.

A huge bastion is thrust forward, as though even yet to repel an attack. One cannot enter the high town except through gates with counterpoised drawbridges, which usher one in to medieval scenes and make him fear that it is not allowed to introduce a camera into what is so patently a fortress.

Up from the harbor there climbs a steep road which would have been a stairway if riding had not been the custom of the builders. Down on the other side a narrow ladder of stone descends to the sea, hugging the wall of rock as if afraid to emulate the example of the overhanging corner of the city.

Up to the east gate of the ancient fortress zigzags a steep road like that descending to the harbor, but much more used, since it leads directly to the most populous parts of the high town.

The church of Sainte Marie Majeure, in Bonifacio, has a piece of the true cross confined in a niche in the wall. The mayor and the curé have keys, both of which must be used at the same time in order to reach the sacred relic, which is carried in procession three times a year.

When the tempests of wind and wave batter at the narrow foundations of the

city so fiercely that even strong men take fright, this bit of wood is carried forth before anxious throngs in an effort to calm the waters.

The stratified nature of the rock on which Bonifacio rests makes it at the same time a city built upon a rock and upon the sand. Little by little the softer portions of the cliff are carried away from between the more durable strata, and little by little the foundations of this city, which never yielded to force, are being stolen by the jealous waters and the restless wind.

In the covered loggia before the cathedral old men talk politics and boys and girls play with rubber balls and shout and laugh, while the abbé beams upon them. Good man, he has a rosy-cheeked niece of two who wears a red coat and, as he says, is "quite English"; so his eyes have a human quality in them which commands respect, but not silence.

He took me to visit the church of St. Dominique, a 13th century edifice, of which he is the curé.

Once the building beside the church was a monastery and the monks entered it through a covered passageway which arches the road. Later this structure became a barracks; now it is a school.

CAMEL'S HAIR ROPE USED AS A WATER PIPE

Over in a corner of the citadel is the well of St. Bartholomew, down whose somber depths we descended by a circular staircase of 300 steps, cut in the limestone, to a narrow door which gives on the sea. The rope of camel's hair, which once supplied the garrison with drinking water, has long since rotted away, but the rollers through which it passed to squeeze out the water, brought up more than 200 feet from the pool below, can still be seen.

This shadowy stairway is entirely shut out from the light of day, but outside, slanting at a daring angle down the cliff, is the stairway of the King of Aragon, which, *"on dit,"* was built in a single night. Nowhere except on the mushroom of Sigiri, the lion fortress of Ceylon, can one find a more venturesome stone ladder, and if it wasn't built in the darkness of a single night, there are sections of it that reveal a type of architecture that would result from such feverish tactics.

From the quay, if the wind is not too high, one takes a boat and rows out around the lighthouse of La Madonetta and into the grotto of Sdragonata, a wonderful place, paved beneath blue waters with stones of Tyrian purple and lapis lazuli. In midwinter the sun sets just outside the jagged portal against which the fierce waves would toss a boat and crush it as in the jaws of some fearsome marine monster in any but calm weather.

But more interesting than the grotto itself is the peculiar opening in the roof through which the light pours, making this less of a cavern and more of a museum of submarine colorings. This window toward the sky is shaped almost exactly like the island of Corsica.

Down the tumble of rocks which the collapse of the roof has left at the western end it is proposed to build a pathway, so that one can enter the cavern on foot. As well run elevators down into Capri's blue grotto!

I stayed in the cavern until late afternoon had added a rosy ceiling. Then, with the sun setting behind La Madonetta, whose single sparkling eye had waked to its nocturnal watch at the mouth of the dangerous stairs, I passed in between those towering cliffs to the harbor, with greasy lights already showing in the low groggeries of the longshore; then along the white ribbon of road to the isolated hotel, from which all sight of Corsica's most picturesque city was shut out.

By moonlight I went back along that white road and through the darksome portals, which, as though by some oversight or treachery, were still open. There was hardly a footfall in the stone streets, hardly a light in the overbearing walls; then a burst of noise from a hidden hurdy-gurdy, and later the light plucking of a guitar.

The sky was such a sky as moonlight brings to Venice. No shadowy canal rippling to a line of silver at the sharp prow of a gondola was narrower than those dark streets. No patter of donkey hoofs, no swish of corduroy as by day. There was scant sound until I passed once more the ancient drawbridge. I walked head on into the roar of the sea at the foot of the beetling cliff on which Bonifacio balances itself like a Blondin above the surge of Niagara.

A NORTHERN CRUSOE'S ISLAND

Life on a Fox Farm Off the Coast of Alaska, Far from Contact with the World Eleven Months a Year

By Margery Pritchard Parker

IN these days of congested population, rapid transit, telegraph and radio connections, it is hard to imagine people living in solitude like that of Robinson Crusoe. Yet this hero, so much admired by youthful readers of an earlier decade, was no farther from neighbors than are the dwellers of to-day on a certain island in the North Pacific.

Middleton Island lies 160 miles off the southern coast of Alaska, almost due south of Cordova, a town of 1,000 inhabitants. From no point in its area of a little less than eight square miles is there anything to be seen except limitless sea and sky.

The Indian name for the island, Achaka or Achatsoo (which sounds very like a sneeze) means "The Harborless." It is a descriptive title, for in all the shore line there is no safe anchorage for boats of any sort.

Steamers having business at Middleton must stay well outside of the dead line of crashing surf which surrounds it nearly every day of the year, and take the hazard of sending in a small boat. Rarely can the occupants of such boats reach the shore without a thorough drenching, if nothing worse happens to them. More than once a schooner, after a day or more of standing by, has been obliged to wig-wag a disappointed farewell and depart without having accomplished her errand.

THE ISLAND IS OFF THE COURSE OF SHIPS BOUND FOR THE NORTH

Callers at the island are few and far between, however, as it is off the course of boats bound for Seward, Nome, and the Arctic. Once in a blue moon, one of the fishing boats which ply along the Alaskan coast turns off the beaten path to pay the island a friendly visit, and is lucky if its dory is able to make a landing.

No postman makes an unfailing daily call upon the islanders, no telephone bell tinkles its welcome summons to communication with the outer world. Not even a trail of smoke or a sail on the horizon is sighted for two, three, or even six months at a time; yet in this utter isolation two voluntary exiles live in comfort and contentment for eleven months of the year.

Since 1890 Middleton has been leased by the Government to various private concerns as a breeding farm for blue foxes, and in consequence there has been a succession of Crusoes in charge of the place. The present one is by birth a Bostonian, who emigrated to the Yukon during the Klondike rush, and thence crossed back to Uncle Sam's territory on the trail of another "big strike."

Like many another in those hectic days, he made and lost fortunes, traveled and prospected over many hundreds of miles of that vast country, and acquired what your true Alaskan always possesses—the ability to turn his hand to any occupation which comes along and to make it go.

MRS. CRUSOE WAS ONCE A BOSTON SCHOOL-TEACHER

Unlike Defoe's famous hero, this modern Crusoe brought an excellent partner to share his solitude. Mrs. Crusoe was a Boston school-teacher until her exodus to the far Northwest ten years ago. She is a wee slip of a woman, whose indomitable spirit triumphs over a frail physique and keeps her a close second to her husband in all his undertakings.

In 1918 these two sold a prosperous restaurant business in Cordova, Alaska, and left that thriving little town to begin their experience in fox farming on Middleton, out in the ocean. Both had great reserves of courage to face the isolation, optimism as to financial results, and intelligence to make the most of every interest which their small domain might afford.

The "Friday" of this island is a patient old black horse, who was abandoned by

Photograph by Fred C. Schiller

THE CABIN OF THE FOX FARMERS ON MIDDLETON ISLAND

The American flag floats from a staff 50 feet high cast up on the beach after a storm (see text, page 323). The foreground is one mass of wild flowers in spring. The sheds and small buildings to the right have been constructed out of driftwood.

Photograph by Mrs. Fred C. Schiller

A CLOSE VIEW OF THE BRAVE LITTLE HOUSE IN WHICH THE CRUSOES LIVE FOR ELEVEN MONTHS OF THE YEAR

Note the rain barrel, an important factor in the life of the islanders. A fair amount of rainfall, especially in summer, is also conducive to the production of good fox fur. The raising of blue foxes is an industry of great importance to the Alaskan coast, for it utilizes outlying islands of no particular value for agriculture. Most of the blue foxes in Alaska are raised primarily for pelts, and not for breeding purposes.

former owners when they left the place. Friday saw no human being for three years. In summer he could easily feed himself upon the abundant growths of clover, timothy, redtop, and wild peas; but it makes an animal-lover cringe to think what the poor fellow must have endured in winter, when all the fodder was covered with snow and raging storms swept over the island.

When the Crusoes came, it took some time to reclaim Friday from the wild and convince him that they were friends; but now he is an honored, trusting, and faithful member of the firm. His chief duty is to drag from point to point a sledge containing the fox feed; it is also his job to haul kelp for fertilizing the gardens and to help salvage the heavy driftwood.

Most of the time Friday roams at will, but never goes beyond call from the house. Upon the approach of a storm, he retires to the shelter built for him and stands contentedly looking out, knowing full well that warm mashes of potatoes and salt will be served to him until the wild weather subsides and he can again provide for himself.

THE ISLAND IS IDEAL FOR FOX BREEDING

The breeding of blue foxes in captivity is not an easy undertaking, owing to the extreme shyness of the fox family. They do not readily grow accustomed to man, but generally have the attitude of wild animals on the defensive. A mother fox, when alarmed, has been known to kill her offspring on the instant, and the constant nervousness of the animals even affects the quality of the fur.

On the island the foxes are unaware of being prisoners, as they roam freely; so they rear their young in the natural way, double their number annually, and produce skins of great beauty.

The blue fox has a long-haired fur, of a soft gray tone at the ends of the hairs, shading to a dull blue close to the pelt. An average price in the London market is $175, while exceptionally fine skins may bring $375.

The chief duty of the fox farmer is to provide and daily distribute fresh food for his charges, at stations scattered about the island, especially during the winter months. Besides a small proportion of vegetables, rations consist of rabbits and the flesh of the hair seal when it can be obtained. The last requires expert marksmanship, as the seal must be shot through the head in order to float ashore; otherwise it sinks and is lost.

Drawn by James M. Darley

A SKETCH MAP SHOWING THE LOCATION OF MIDDLETON ISLAND

Middleton is one of ten islands leased by the U. S. Biological Survey to individuals for the purpose of raising foxes. It is reported that in 1911 there were six animals on the island. Last year 59 were killed for their pelts and 35 were retained for breeding purposes.

In summer the foxes will leave the food in the feeding boxes and go foraging for themselves, running along the beach in search of fish eggs and small fish washed up in the kelp, or climbing the cliffs to rob the sea-pigeons' nests of eggs and squabs. The animals are seen at close range only in December, when they are lured into box traps. Here the breeders are sorted out and liberated, while those whose skins are marketable are humanely dispatched.

ISLAND TEMPERATURE RANGES FROM 20 BELOW ZERO TO 110 ABOVE

Climatic conditions on Middleton are agreeable on the whole, except for the strong and almost constant winds which sweep it. The lowest temperature recorded is 20 degrees below zero, the highest 110. There is an annual rainfall of about 96 inches and from two to four inches of snow in winter. The succession of seasons is not unlike that of New England, although the summer is much longer. Spring on Middleton begins with the reappearance of plant life, about the middle of February. From this time on, the

Photograph by Fred C. Schiller

CLIFFS AT THE NORTH END OF MIDDLETON ISLAND, WHERE THE SEA PIGEONS NEST
(SEE TEXT, PAGE 320)

Photograph from Biological Survey

SEA GULLS FEEDING IN THE WAKE OF A VESSEL OFF THE COAST OF ALASKA

Gulls do not enrich the larder of the fox farmers. Their eggs have been found to have a strong fishy odor and taste. Sea-pigeon eggs, however, prove most acceptable.

Photograph by Fred C. Schiller

BUILT BY THE CRUSOES ENTIRELY OF DRIFTWOOD

The sign is 14 feet long by 3 feet wide and is painted yellow, with the figure of the fox "serenading the moon," in blue. The letters are red.

sun shines warmer and longer each day until the summer solstice. Between May 1 and August 15 there are from 15 to 20 hours of sunlight daily, and during June and July no darkness at all. But the islanders pay for this luxury in the long nights of winter, when conditions are reversed, and they get hardly more than a glimpse of Old Sol during the entire month of December.

One of the natural beauties of the island is a chain of lakes, clear as crystal and large enough to afford the pleasures of boating. Scattered along the shores of the lakes are the only trees which the place possesses—12 small spruces, battered and bruised by the winds, but refusing to give up the fight. Grass of 12 varieties flourishes everywhere, sometimes growing six or eight feet high.

BIG SIGN TELLS THE VISITOR WHERE HE IS

The object which first catches the eye of a visitor, if he successfully negotiates the surf and lands on the beach with all his faculties unimpaired, is the imposing sign which serves as a gateway to the island. It is 14 feet long and 3 feet wide, standing 12 feet above the ground, and is painted yellow, with the words "Middleton Island Blue Fox Farm" in red. In one corner is the figure of a handsome blue fox apparently engaged in serenading the moon or possibly in the less romantic business of "hollering for more." This enterprising production proves Mr. Crusoe to be an artist of no mean ability.

Some distance beyond stands the brave little house, neatly painted and, in summer, half covered with vines and flowers. Years ago the lumber for the house was brought from the States; all the rest used about the place—for rabbit houses, root cellar, tool house, Friday's shelter, fences, trellises, signboard—was salvaged from the sea. From this source also came the material for many clever conveniences in the house, as well as for most of the furniture.

In the midst of this seclusion, what sources of interest, study, and diversion exist whereby two people may keep themselves mentally fit? Both will tell you that these are many and varied.

"In the first place," says Crusoe, "there is an immense satisfaction in proving oneself equal to the test of being wholly on one's own resources; this must be done in surroundings like ours, in order to survive. We feel no loneliness, as we have no idle hours; there is plenty of work and no union to dictate when it shall be done.

Photograph by Fred C. Schiller

TENDING HER NASTURTIUMS

A table leg found on the beach, topped with a pail and painted green, made an effective ornament. Pansies fill the window-box.

"Our first care is to provide rations for the foxes, and the round of the feeding stations must be made daily, regardless of wind and weather. All our fuel is driftwood, dragged from the beach a mile away and cut up by the old-fashioned method of muscle and hacksaw.

"To vary the monotony of a tin-can diet, we grow several large gardens, which keep us busy many days of the long summer. The soil is of glacial origin, with a rich loam subsoil, and produces splendid crops when fertilized with kelp. Last year we raised 125 bushels of A No. 1 potatoes, and about the same of rutabagas, for fox feed. We also had an abundance of lettuce, radishes, parsley, green onions, carrots, and peas.

"The only wild vegetable we use is the dandelion, old friend of our New England days. Here one may enjoy 'a mess of greens' as early as the first week in April, and later the plant grows to the height of two feet or more and blooms twice in a season.

"There are no enemies of plant life on the island. Picture the joys of horticulture without aphis, cutworm, or potato bug! The mosquito, that terrible pest of the Alaska mainland, is also absent. Evidently it was not on Middleton Island that the Indians used to tie a man naked in the woods in mosquito time as a form of capital punishment.

"However, for three weeks in August life is made miserable by the tiny gnats called by the Indians 'No-see-ums,' which will go through any netting yet devised by man, and therefore cannot be kept out of the house entirely. Fortunately, we have an insect powder to the fumes of which the tormentors will succumb. Outside they swarm in such numbers that if one inadvertently inhales through the mouth he cannot avoid swallowing a few, and will be miserable until he succeeds in coughing them up.

"Unlike the original Crusoe's Island, ours was not provided by Nature with fruit trees. But during the last week of June great quantities of wild strawberries ripen all over the island, and for a month we revel in them. Then, in August, the salmonberry bushes are heavily laden

A PORTION OF THE POTATO CROP ON MIDDLETON ISLAND

Photographs by Mrs. Fred C. Schiller

A CLOSER VIEW OF MIDDLETON ISLAND POTATOES: THE THREE ON THE SCALE WEIGH 6 POUNDS

Potatoes provide a large part of the food for the foxes in winter. After being boiled in large tubs they are mixed and mashed with corn meal and seal oil. In summer the foxes are able to provide for themselves, living largely on fish.

© Lomen Bros.

THE ALASKAN MIDDAY SUN IN WINTER

The arc described by the sun in latitude 64 degrees 29 minutes north on December 28th. Taken from the beach at Nome, Alaska, looking south across the ice fields of Bering Sea. Five exposures were made on one negative, the camera remaining in the same position for four hours. Exposures made at 10 and 11 o'clock a. m., noon, 1 and 2 o'clock p. m.

with ripe berries, almost any one of which would fill an after-dinner coffee cup.

"Delectable strawberry preserves and salmonberry jelly are two of the luxuries which Mrs. Crusoe provides for our winter menu. Of course, our staples, in large quantities, are brought in from Cordova yearly.

SEA PIGEONS PROVIDE EXCELLENT EGGS

"When we need eggs we betake ourselves to the great chalk cliffs at the north end of the island, where the sea pigeons nest. Stretched flat on the cliff top, with a hook-and-bag contraption, we fish up the eggs from the ledges below. They are a trifle smaller than hens' eggs and of excellent flavor. Early in our stay here we tried gulls' eggs, but were glad to leave them for the foxes, as they have a strong fishy odor and taste.

"When the game season opens, on September 15, our lakes are filled with game birds, feeding and resting on their way down from their summer in Arctic regions, and for two months we use all we need. Unfortunately, the birds all leave before the weather is cold enough to freeze the meat for winter use.

"Some months ago, being ravenous for fresh meat, we sampled the flesh of a young hair seal just killed and found we had hit upon a real treat. The meat, which resembles venison in appearance, was juicy and delicious when roasted, and the liver more delicate than calves' liver.

"One of our duties, which is also a diversion, is a daily log recording observations of weather, wind, temperature, and any items of natural history which we may have acquired. Chief among the latter are facts regarding the birds, both the migrants and those which breed here. The former include several varieties each of the Sandpiper, Grebe, Duck, Merganser, Curlew, Goose, Teal, Widgeon, Gull—in fact, almost every water

bird of the Pacific coast. Among the land birds seen in migration are the Robin, Jay, Owl, Magpie, Sparrows of various kinds, Grosbeak, Humming Bird, Phœbe, and Arctic Three-toed Woodpecker.

"We have built several types of bird-houses about the place, hoping to induce some of the songbirds to remain with us during the summer, but so far they have declined our hospitality. Occasionally a pair of Trumpeter Swans is seen, or magnificent Golden Eagles soar far above. These rarely stay more than a few hours, as their powerful wings are much sooner rested than those of the smaller birds.

"Any time after April 15 we look eagerly for the return of the Sea Pigeons, Puffins, Guillemots, Cormorants, and Terns, all of which breed on the island. They nest in colonies, each species by itself, on the ledges of the cliffs. Many are the tragedies which occur here among the feathered folk. Besides the depredations of the foxes, they are exposed to storms, which often cause tons of earth to go crashing into the sea, carrying down eggs and baby birds.

"We find it most amusing to watch the curious ways of our bird neighbors, particularly the Sea Pigeon; he is quite friendly and does not fear us, although he has a comical habit when disturbed of circling about above the nest, crying distractedly, 'Look at that! Look at that!'

"There has been a rumor that the Government will make Middleton a bird sanctuary. Much as we love the birds, we do not favor the suggestion, for it would mean that we and our foxes must seek another abiding place; it would be difficult to find one as suitable to fox-raising as this, in the points of size, location, and climate.

STUDYING THE HEAVENS PROVIDES ENTERTAINMENT

"Although astronomical knowledge is not among our acquirements, we greatly enjoy the study of these northern heavens on clear nights. By the middle of August there is sufficient darkness to bring out the glowing beauty of the stars, which seem very close to the earth, and the full moon of this month is a great, luminous orb, as yellow as an orange.

"Through the winter months, on every clear, cold night, the weird aurora borealis streams across the sky. Much has been said about the aurora which is even more weird than the phenomenon itself. A description which comes near to being both adequate and truthful was written by John Jasper Underwood in the volume called 'Alaska, An Empire in the Making.' Robert Service, in one of his inspired moments, drew an effective, if somewhat bizarre, pen picture of this glorious spectacle. It is certainly one of the wonders of the globe. Many a night or early morning we have stood watching its awesome display with fascinated eyes, until sharply nipped by frost.

"With excellent health, congenial occupation, and these and many other interests, we are finding our few years here an experience quite worth while."

FLOWERS IN PROFUSION, BUT NO BUTTERFLIES OR BEES

Mrs. Crusoe is equally optimistic and supplements her husband's description of their busy, cheerful existence:

"When we find the dandelions large enough for greens, we know that the season of flowers is at hand, and from that time until September the island is a marvel of color. About the middle of April the first flower appears, a small yellow blossom which we cannot identify. Next come wonderful purple violets as large as pansies, growing on stems 10 or 12 inches long. Following these comes almost every variety with which we were familiar back in New England, except the Goldenrod and the White and Ox-eyed Daisy.

We have the Anemone, Spring Beauty, Lily of the Valley, Solomon's Seal, white and purple Hyacinths, Harebell, August Aster, Yarrow, Larkspur, Columbine, Monkshood, Wild Geranium, Blue-eyed Grass, Lupine, Sweet Pea. We have recorded 72 kinds in a season. All are odorless except the wild Hyacinth, which grows in great profusion and fills the air with a delicious fragrance.

"Long after autumn frosts have taken all other flowers, patches of fleecy Alaska Cotton are still scattered over the low places, like small banks of snow. In addition to the wild flowers, we have a bit of garden around the house, where Pansies, Nasturtiums, and English Poppies bloom luxuriantly.

"Once a storm deposited on our beach

Photograph by Mrs. Fred C. Schiller

THE STEMS OF THE VIOLETS ON MIDDLETON ISLAND ARE FROM 10 TO 12 INCHES LONG

MR. AND MRS. CRUSOE IN THEIR ILL-FATED PIGEON YARD

"We took some pigeons with us the first year, hoping to raise squabs for fresh meat, but the foxes got into the pigeon house at night and killed pigeons as well as squabs, thereby cutting off our meat supply."

Photograph by Fred C. Schiller

SETTING OUT ON THE DAILY ROUND TO CARRY FOOD TO THE FOXES

The cart drawn by the good horse Friday is fashioned like a big sled. Note the ledge or shelf on which the birds build nests and which the foxes can reach very easily. In severe storms tons of earth break off from the cliffs, carrying nests and young birds to destruction.

a carved table leg, which, topped by a green bucketful of glowing Nasturtiums, constitutes one of our most cherished ornaments. Amid this wilderness of flowers it would seem natural to find hordes of butterflies and bees. Whether it is due to the leagues of salt water between us and the mainland, we do not know, but we never have seen a butterfly here, and only an occasional lonely bee booms among the Pansies.

A CAMERA, BINOCULARS, AND A FLAG ARE TREASURED GIFTS

"Three gifts from friends are sources of pleasure to us. Our good little camera registers some of our varied and uncommon experiences, which will be entertaining to remember when we two old folks, like Darby and Joan, sit in the chimney corner recalling the past. A pair of excellent binoculars is constantly useful, particularly in bird study, and when we sight a speck on the horizon it is not long until the glasses are trained upon it, to determine whether it is a boat, and thus a possible caller, or just another piece of driftwood.

"Once, before we had the glasses, when we had begun looking for the schooner which comes each January to take us to Cordova, we sighted a boat a long way out, but apparently headed in our direction. In wild excitement we hustled things into our suitcases, carefully closed the house, and, hitching Friday to the sledge, trundled the baggage down to the beach. Then, looking out to sea for the first time since our mad rush began, behold, no boat was to be seen! A faint trail of smoke on the horizon told us that she was only one of the 'ships that pass in the night!'

"The gift which, perhaps, pleased us best of all, in point of sentiment, at least, was a four-by-six American flag which we brought back one January. We hung it on the wall of the living room and admired it there, but regretted that there was no pole from which to fly our colors properly.

"Finally, one morning in June we found that the storm of the previous night, while bringing disaster to some ship, had fulfilled one of our dearest wishes, for there on the beach lay a beautiful, tapering mast, 50 feet high! It was soon planted firmly in the earth near the house, and on July 4th, with appropriate feelings, if not ceremonies, Old Glory was flung to the breeze. On every holiday now, we look

Photograph from Biological Survey

FEEDING BLUE FOXES ON BROTHERS ISLANDS, SOUTHEAST OF MIDDLETON

up at its folds floating bravely over the lonely little isle, with a warm sense of security which only our national emblem can give.

NATIONAL HOLIDAYS AND BIRTHDAYS CELEBRATED

"We never allow Memorial Day, July 4th, Thanksgiving, Christmas, New Year's, or our birthdays to pass without doing something to give the day an air of festivity. On May 30 it is likely to be an evening of Victrola music, with stress on patriotic airs played by good bands; on July 4th, perhaps a picnic on the lake shore. A dinner as "special" as the larder will permit graces our table on Thanksgiving Day, and Christmas candles glow in our windows.

"And what do you suppose we do on New Year's Eve? Shove the furniture back against the wall in the tiny living room, turn on the dance music, and 'trip the light fantastic toe' as long as it pleases us. When one of us has a birthday, he dons his most joyous raiment and sits in state while his partner builds a lofty cake topped by one lone candle; candles are not too numerous and, besides, we don't care to be more explicit!

THE DAILY PAPER IS READ REGULARLY

"Our beach would be a joy to the geologist, so full are its sands of curious and interesting things—lovely shells, petrified woods, and minerals of many sorts. We have a wee bank account which we dug out of the beach. The finest gold, such as made the Nome beach famous, is occasionally found here in small quantities.

"When the garden produce is all gathered and the short days are with us, it is very pleasant to turn to the two bookcases Mr. C. has made, with their welcome store of reading. Besides our small library of books, they are well stocked with files of magazines saved for us by thoughtful friends on the mainland. No matter if they are a year old or more, we read them from cover to cover with huge enjoyment. And every day of the year, directly after breakfast we read our daily paper. How do we get it? Why, in January we bring from Cordova our year's file of the *Boston Transcript,* each number of which is

Photograph from Biological Survey

A BLUE FOX ON AN ISLAND OFF THE COAST OF ALASKA

The origin of the blue foxes on the Alaskan islands is traced either to the Pribilofs or to animals brought from Siberia by the Russians.

eagerly read, just one year after publication! Of course, it is a deprivation not to know the news up to date; during the World War it was particularly hard.

NOT LONELY AND NO WILD ADVENTURES

"One would expect such a situation as ours to be productive of thrilling tales of loneliness, wild adventure, and all manner of crises. We are not lonely and we have had no wild adventures, but each January, when we leave the island and return to it, we take our lives in our hands in the passage of the terrific surf.

"Every day life here is full of potential dangers: a furious winter storm, a fall from the cliffs, a shooting accident—any of these might bring upon us the suffering and sorrow which we have so far escaped. Long ago we learned that we must not dwell on these painful possibilities, if we were to live the healthy, sane, and cheerful life which is the human birthright.

"The most serious situations which have confronted us have been shortages of food. The first year we came here we were inexperienced in provisioning and did not bring as ample supplies as we now know we shall need in a year. The men from the schooner, in haste to return while the surf was navigable, deposited our stores on the beach, and before we could get them to the house everything was soaked by a terrible downpour of rain.

"A large part of the flour and cereals spoiled; consequently we had none after the first of November. About the same time our ammunition became exhausted, and, with an empty gun, we could only sit and groan as we watched hair seals sporting in the ocean and hundreds of game birds on the lakes. We muddled through on potatoes, rutabagas, and canned stuff; but those were lean weeks and convinced us that it would be possible to starve in the midst of plenty.

ENTERTAINING HONEYMOONERS AND SHIPWRECKED SAILORS

"We had nearly as critical a time when my brother and his bride came to visit us, to our great delight. Being wholly unaccustomed to the needs of frontier life, however, they brought no supplies, and

FRIDAY HAS BEEN A RESIDENT OF MIDDLETON ISLAND FOR 10 YEARS

He is standing in a garden patch which will yield rutabagas weighing 20 pounds each. The horse was deserted by the former residents on the island, and had to shift for himself summer and winter until the Boston couple arrived and adopted him (see text, pages 313 and 315).

the commissariat was pretty well depleted before the Cordova boat came. Worst of all, the two smokers were tobaccoless for a fortnight, to the decided detriment of their tempers; it surely was a trying test for the honeymooners.

"The greatest thrill we have had was when a shipwrecked crew of 26 men managed to make a landing on Middleton, half dead from hunger, thirst, and exposure. Some of them were able to stagger to the house; others lay on the beach until revived by the hot coffee and soup which we brought to them. Their famishing hunger was tragic to behold. So was the rapidity with which our meager supplies disappeared, and our boat for Cordova was not due for two months! Fortunately a liner, off her course, came near enough to see our signals, took the poor fellows away, and restocked our larder.

BACK TO CIVILIZATION FOR A MONTH

"The first pleasant weather in January sees us on board the schooner *Rolfe 2nd* on our way to Cordova for a month's stay. Our most important business there, after seeing our furs off for London, is the buying of our equipment for the next year—food, clothing, tools, ammunition, reading matter, and a hundred and one sundries, all essential. Though we keep a careful list for months beforehand, something is sure to be forgotten; but when the thing you need is nearly 200 miles away—well, you don't need it!

"Then for days we are engaged in the absorbing occupation of reading and answering the letters which have been coming to our Cordova address for a year. Can you vision the possibilities of both comedy and tragedy in going through a year's mail all at once? Sometimes, if the Seattle boats run on schedule time, we can send letters to the States and get a reply before our departure—a gratifying event indeed.

"The amusements and social life of the town, which was our home for several years, delight us anew each year; to mix with crowds and feel again the pulse beat of the world is vastly stimulating and agreeable. We find entertainment in the stores, restaurants, and movies; we miss none of the jolly weekly dances; and, most of all, we enjoy the homes of our friends, where we receive a welcome that warms the cockles of our hearts.

"As our holiday draws to a close, we begin to think about the island, and the cosy little house, and the wonderful sunsets, and good old Friday—in short, we are quite ready to turn our backs on the joys of urban life and go home to our work. And when the *Rolfe* steams out of Cordova Bay, on the return trip, she bears two cheerful and contented passengers back to the fox farm on Middleton Island."

THE HAIRNET INDUSTRY IN NORTH CHINA

By H. W. Robinson

THE people of China are, and have been for centuries, primarily farmers. Their chief essentials of life—food, fuel, and clothing—are mostly of home production. Even in North China, where the winters are cold, clothing comes principally from cotton raised by the northern farmers, and fuel still consists largely of the grain stalks from the fields that provide the food. The people require but little from the outside world and produce little that they do not consume themselves.

But the old order is changing. Although the northern people are less progressive than their southern brothers, even among them modern industries are gradually springing up. Perhaps none of these infant industries has had a more phenomenal growth than that of making hairnets, which now gives employment to thousands who are providing these articles for millions of women in America and Europe.

Although the industry was introduced in China by the Germans only 15 years ago, in 1920 more than 140,000,000 hairnets were shipped to America from a single Chinese city, and the total annual exports of this product are valued at more than $10,000,000.

The nets are made by hand and the workers receive about one cent each for making them. The average person can hardly make ten a day.

THE CHINESE HAIRNET INDUSTRY WAS A WAR BABY

Before the World War, Italy and Galicia shared with China the responsibility for producing most of the hair used in hairnets, while their manufacture centered in Alsace-Lorraine, Galicia, and Bohemia. During the period of hostilities, however, the industry gradually drifted to China and hairnets are now practically an exclusive product of that country.

The province of Shantung has been the largest producer, but during the famine of 1920-21 the industry spread to other provinces, especially to the Chihli cities of Peking, Tientsin, and Paotingfu.

While the hairnet industry centers in the cities, the nets are actually made in country villages. A tourist in China can visit a match factory, a rug shop, a cotton mill, or an egg-drying establishment in some large city and see the whole process; but if he wants to study the hairnet industry, he must get out into the country and visit village homes. To be sure, there are a few workshops in some of the cities, like Chefoo, where exporting houses collect the nets and prepare them for shipment, but the actual making goes on in the home.

WHY THE INDUSTRY HAS CENTERED IN NORTH CHINA

There are three important factors that have made the hairnet industry almost exclusive to North China: first, a large supply of hair is found there; second, cheap labor is plentiful, and third, the industry requires no machinery and can be carried on in the home.

Where will you find more human hair than in North China? Before the rule of the Manchus, the Chinese men let their hair grow rather long and tied it in a knot on top of the head. When the Manchus came, in the 17th century, they wore their hair in long braids down their backs, and as an indication of subjection forced the Chinese to adopt the same custom.

Thus began the history of the world-famed Chinese pigtail, and for two and a half centuries China has not only had the greatest number of heads, but she has also had more hair per head than any other country.

Probably no other land has a more distinctive national peculiarity than the Chinese pigtail, and, like so many other social customs, it persists long after the cause for which it stood. The revolutionists of 1911 tried to do away with it and ordered that all queues be cut off. Those who objected were in danger of losing head as well as pigtail, and the queues provided a handy means of suspending the heads along the city streets as an effective suggestion that the revolutionists meant business in their attempt

Photograph by M. Hartung

A STREET SCENE IN NORTHERN CHINA: QUEUES LIKE THESE HAVE MADE THE HAIRNET INDUSTRY POSSIBLE

Photograph by Robert Scheindlenger

A BARBER PLYING HIS TRADE IN TIENTSIN

Photograph by M. Hartung

A GROUP OF CHINESE GOVERNMENT STUDENTS BEFORE THE REVOLUTION

In those days students were proud of their long queues and even braided silk in with the hair to make them look longer. At present a student with a queue in a Chinese middle school or college would be as much out of place as he would be in an American college. The students are the most patriotic class in the Chinese Republic and would be the last to return to the Manchu régime. They no longer grow hair for the hairnet industry, but have done much to promote new industries.

to do away with the badge of the victorious Manchus.

In the south, and in large cities in general, the queues did disappear to a great extent, and for a time there was a flood in the human hair market.

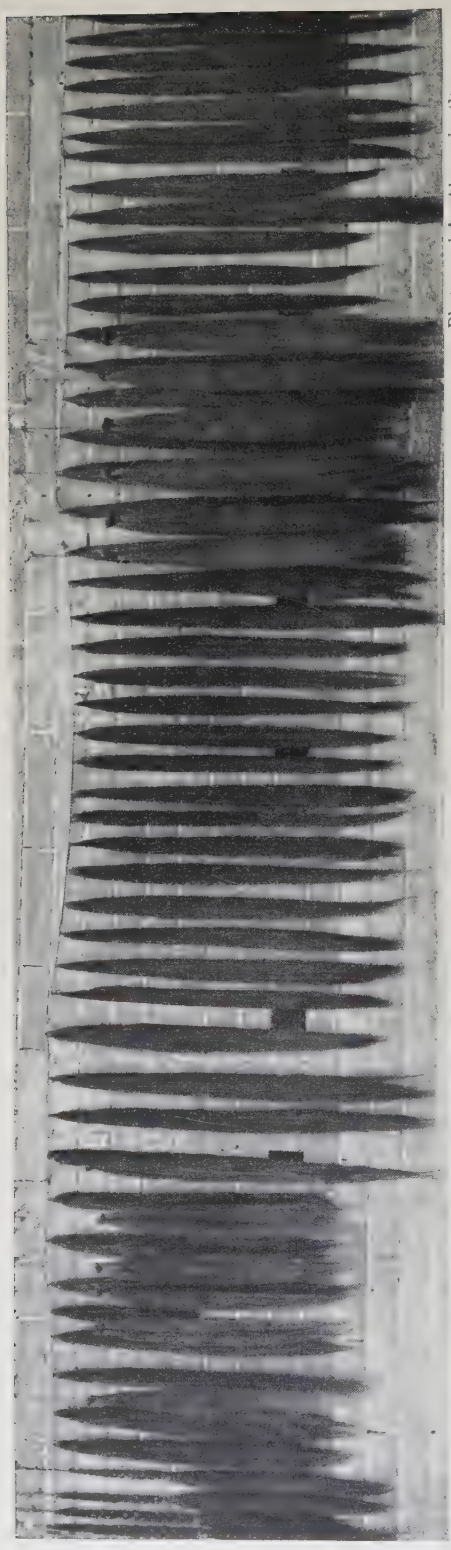
But in North China the law forbidding the wearing of queues was not enforced, and they are still plentiful in Peking and Tientsin, while in some country villages away from the coast there are nearly as many boys and men with queues as without.

Some of these wearers of queues hope that the Manchus may one day be restored to power. The Chinese Republic has not been very satisfactory to the peasant class of China. One revolution has followed another, and the spendthrift methods of military rulers have made it harder and harder on the laboring people. The people do not care so much about the form of government in Peking as they do about the price of grain. Many would gladly go back to prerevolution days, and their queues are ready to welcome the return of their former rulers.

In July, 1917, when Chang Hsun staged his little farce in Peking and put the Boy Emperor back on the Dragon Throne, his soldiers all wore queues and were known as the Pigtail Army. Of course, Chang Hsun was in sympathy with the Manchus and naturally would follow the customs that they had established; but there is many a peasant who has the same respect for the Manchus that Chang Hsun manifested.

CHINESE HAIR IS BEST FOR HAIRNETS

I am told that there are no queues in Shansi, for the progressive governor of that province enforced the no-queue law. In most places of North China, however, the raising of hair continues, and no other region can well compete with this in



Photograph by Alexander Stewart

QUEUES FOR SALE AT FIFTY CENTS AN OUNCE: SHANTUNG

providing raw material for hairnets. It is claimed that Chinese hair is especially suited for hairnets because it is stronger than the fine hair of European women, and therefore stands bleaching and dyeing much better.

BARBERS SAVE AND SELL COMBINGS

Perhaps one reason why queues have not disappeared more rapidly is because of the many barbers, who depend on combing queues and shaving heads for a living. Whatever hair they can comb out belongs to them and becomes a source of income; so, naturally, they are not in favor of a queueless country.

In the cities there are barber shops, but in the rural districts barbers travel about from place to place and carry on their trade in the open streets. Market places and fairs are their favorite haunts, and wherever crowds congregate, there you will find the itinerant barber.

Both he and the stationary barber spend their odd moments unsnarling their combings and arranging the hair according to length. Sometimes they also weave it into switches, to be sold either at the shop or at the market places and fairs.

Chinese women do not patronize the barbers, but comb their own hair at home. Nothing is wasted, however; the combings are saved from day to day and, when a sufficient quantity is collected, it is sold or exchanged for small household articles. In some places venders travel from house to house, calling out, "Needles, thread, and matches exchanged for hair combings."

This raw hair is sold very cheaply, and, when girls are learning to make nets, is used for practice purposes.

Enough hair can be purchased for 50 cents to last a class of 60 or 75 girls a month, while they are learning to make nets. As soon as they are able to make salable nets, they use prepared hair, which costs as much as several dollars a pound, depending on length and other qualities. A pound of hair will make over 2,000 nets, for a whole gross of hairnets weighs only about one ounce.

The processes of bleaching and dyeing the hair are the most difficult parts of the hairnet industry. All the raw hair was formerly shipped from China to Europe or America, where it was bleached and

Photograph from Eastern Products Company

REPAIRING HAIRNETS IN THE WAREHOUSE OF A LARGE EXPORTING FIRM

Nets made in the village homes are often imperfect and each one has to be looked over carefully. Many of them must be repaired before they are shipped abroad. The black bundles on the table in the foreground are one-gross bundles of hairnets. The hair for repair work is hanging on the lines strung across the room.

Photograph by Margaret Smith

VICTIMS OF THE GREAT FAMINE OF 1920-21 LEARNING TO MAKE HAIRNETS

These girls learned the trade in about a month and then were in a position to earn their own living (see text, page 336).

Photograph from H. W. Robinson

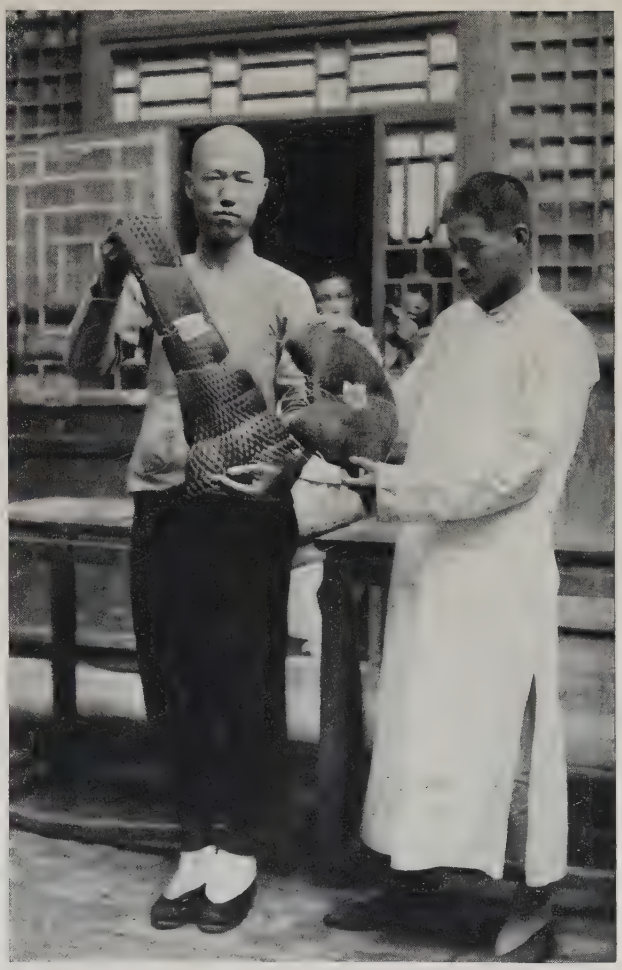
TYING THE NETS UP IN ONE-GROSS LOTS

The nets are stretched on a board into which nails have been driven. Occasionally boys do this work, but it is done chiefly by women and girls. The long nets on the left are the fringe type and the round ones on the right are the cap nets.

dyed by experts, and then sent back to China for manufacture. But as the industry has developed, the preparation of the hair has also been transferred in great part to China.

Probably nine-tenths of the hairnets exported from China at present are made from hair that has been prepared in that country. Chinese firms are undertaking this work, but as they have not yet mastered the scientific processes, their product is somewhat impaired by crude methods and careless treatment. At least one American firm has already completed arrangements to prepare its own hair in China under the supervision of expert American chemists.

Contrary to general belief, nets are never made of split hair. Only whole hair is used, and sometimes double strands are utilized to make a stronger net, but the lighter weight is usually preferred.



Photograph from H. W. Robinson

HAIRNETS AS THEY ARE SHIPPED

This picture shows the fringe nets and the cap nets. Each lot contains one gross and weighs about one ounce.

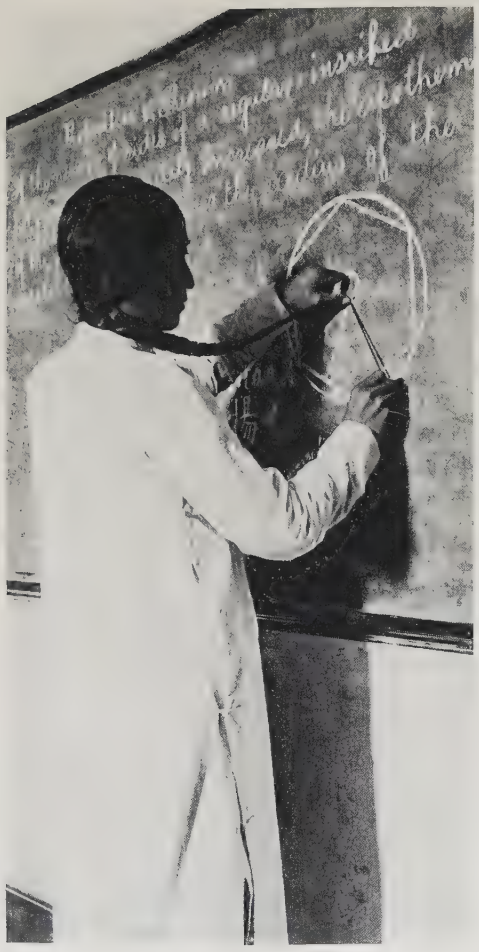
LABOR IS PLENTIFUL

The second factor in the success of the hairnet industry in North China is the almost unlimited supply of cheap labor. Tell a carpenter in this part of the world that his fellow-journeymen in America get from $10 to $15 a day and he will probably inquire at once how much it costs to go to America. He gets 15 or 20 cents a day in United States currency, and other workmen get about the same.

While the American farmer has difficulty in getting satisfactory help at $50 or $75 a month and keep, John Chinaman is willing to dig in the fields for $3 a month, and to find his own keep.

However, it is not men, but young girls, who make hairnets, and of course a girl's wage is much less than that of a man. In fact, there is very little in North China that a girl can do to earn money. Few have a chance to go to school, and except during harvest season, when they help to bring the grain onto the threshing-floors and thresh it, they find it hard to obtain work. Consequently, when a hairnet company enters a region and calls for girls, candidates are numerous.

The fine lace and embroidery which they have made so successfully is evidence that these girls are clever and skillful with their fingers. So, when the hairnet industry was introduced into Shantung a few years before the War, they learned quickly, and those who mastered it first began teaching others. Of course, there have been firms which have promoted the industry; but, once started in a region, it grows of its own accord and spreads from one village to another.



Photograph by H. S. Elliott

A LESSON IN GEOMETRY

A boy of the old régime in Peking University used his queue in drawing a circle for his problem (see also illustration, page 329).

One concrete illustration will suffice to show how the industry expands. About four years ago a native firm was organized in Paotingfu for the purpose of engaging in hairnet manufacture. Seventy-five girls were called in from the country and formed into a normal class.

Trained teachers were brought from Chefoo and the girls were given instruction free of charge for one month. There was only one requirement: that they promise to sell their product exclusively to the company which taught them the trade.

As soon as the first class was finished, the girls went back to their homes to begin their new trade and teach it to others. (No doubt they received a bonus from those whom they taught.) The company kept starting new classes, and its agents took the hair out into the regions where the girls lived, collected the completed nets, and paid the makers.

To be sure, the girls at first earned only a few coppers a day, but it was better than any other employment they had ever had. Some had once tried spinning thread and weaving straw braid, but they could not make a living at those tasks.

ONE CENT FOR TYING 1,000 KNOTS

The hairnet company also undertook to do tatting and to make lace and embroidery, but the demand for the nets in America and Europe increased so rapidly that the production of the other articles has been discontinued, and work is now concentrated on hairnets. When many nets are accumulated, they are taken to Chefoo to be sold to exporters.

Some of these exporting firms, which are mostly American, would be glad to make long-term contracts with Chinese buyers. This method of selling is not very attractive to the Chinese trader, however, for it lacks the element of chance, of which he is so fond. Rather than sell his nets at a good price on a long-term contract, he prefers to take them to Chefoo and sell to the highest bidder on the day he happens to be in town.

This means that the market is somewhat irregular, and consequently the girls never know how much they will receive for their work until the agent comes to collect. However, during the last few years the price paid has not varied much from two or two and a half coppers, or about one cent in United States currency.

A single net requires the tying of a thousand knots or more, but if a girl is clever she can make as high as twenty coppers a day; and, as she can live on much less than that, she often not only supports herself, but helps other members of the family as well.

NEITHER MACHINERY NOR CAPITAL IS REQUIRED

Is it any wonder, then, that fathers and mothers are glad to see the hairnet industry enter their villages? Their daughters, heretofore a burden, are now becoming the breadwinners of the family.

One might naturally ask, "Why are other industries not developed more rapidly in North China, if there is such a supply of cheap labor?"

Part of the answer is that most industries require considerable capital, expensive machinery, and large factories, and, with political conditions as they are in China to-day, capitalists are slow to take the risks.

With the hairnet industry there is no such obstacle. The girls work in their own homes, where they have always been secluded. The only tools needed are a small brass shuttle and a bamboo splint. On a nail driven into a table or chair the first loop of the net is fastened. The hair is wound into the shuttle, like thread into a bobbin, and as each new loop is tied it is slipped onto the bamboo splint like a stitch on a knitting needle. Thus, with shuttle in one hand and bamboo splint in the other, the maker adds knot to knot and loop to loop until the net is completed.

Then the nets are tied together in bunches of one gross each. For this a piece of board, into which nails have been driven, is provided, and the loops on the edge of the net are slipped over the nails until a pile of 144 nets is made. They are then tied with thread and are ready for the agent when he comes to collect, pay for making, and to leave more hair.

Tying into one-gross bunches, as well as tying the hair into one long thread and putting it in the shuttle, is often done by some member of the family who is not able to make the nets. Mothers whose fingers are no longer nimble or whose eyes have lost their keenness help with this part of the work.

Thus the industry fits in well with Chinese home life. It can be done at odd moments by those who have other duties, or it can furnish steady employment to those who would otherwise be idle.

SOME OF THE DISADVANTAGES OF HOME MANUFACTURE

The homes are rather cold for this kind of work in the winter, and the makers' fingers become too numb to be quick. But that only means a few less coppers, and, fortunately, the cold weather does not last long. The homes are very poorly lighted, and as hairnet-making requires clear vision, it becomes a great strain on the eyes. To avoid this difficulty, when the weather permits, the nets are often made in the open courts, where there is good light.

Photograph by R. W. Clack

NOT A HAIR-TONIC ADVERTISEMENT

A Chinese man servant just after he has had his queue combed out.

Home manufacture has its serious disadvantages as well as its merits. Nets made by the piece, with no chance for supervision, naturally are not as well made as in a factory, where the work can be supervised by experts. Many of the nets bought by the exporting firms are imperfect and have to be gone over carefully, one by one, before shipment. This is done in the workshops run by the exporting firms in such cities as Chefoo (see illustration, page 331).

In some cases the nets are also fumi-

gated in these workshops; but, since the hair has to pass through several strong chemical baths in the process of preparation, some firms think this is not necessary.

HAIRNET-MAKING AS A FAMINE-RELIEF MEASURE

The great famine of 1920-21 was a blessing in disguise to many a North China home. When relief workers investigated conditions and began to look around for ways to aid the destitute people in helping themselves, many learned for the first time of the hairnet industry, which was spreading rapidly in Shantung. Money was obtained and in some cases loaned as capital to trustworthy Chinese, who formed companies for promoting the industry in the famine-stricken regions. In other places, companies were already working in the famine areas and they coöperated with the relief workers.

When these workers had found 60 or 75 girls who needed help, a normal class in hairnet-making was organized. Of course, these girls could not provide their own food while away from home, but the relief committees were glad to assume that responsibility, and the hairnet companies furnished teachers free of charge.

It usually took about a month for a class to graduate, and $1.50 would cover all expenses for a girl during her period of instruction. She was then in a position to go back home and become a wage-earner instead of a burden to her parents. She might not be able to earn many coppers a day at first, but if she could earn seven, even with grain at famine prices, she could live on that, and many of them did so.

Oftentimes girls were found who had actually been sold, or for whose sale arrangements were being made, because their parents had no way of supporting them.

It is to these families, especially, that the famine was a blessing in disguise. The girls have a trade now, whether famine or flood comes. So long as American and European women demand hairnets, the girls will have a means of "getting over the days," as they express it in the Chinese language.

Unfortunately, the hairnet companies do not continue to distribute hair in all places where girls who have learned to make nets live. In most cases the companies will receive only lots of one gross or more, and it takes some of the girls two or three weeks to make a gross. Some buyers go from one market place to another, just as the barbers do, and buy up nets in small quantities of less than a gross. This makes it possible for girls to sell their nets every few days, and the buyers tie them up in one-gross lots and sell to the larger firms.

Whether or not the wearing of hairnets is a passing fad, who can say? I am told by one who is in the business that the article in the United States is no longer considered a luxury, but a necessity, by most women.

If it continues to be in style for many years, it looks as if North China will continue to be the center of the hairnet industry. Human hair is there in large quantities and growing all the time; nimble fingers are waiting to tie it into nets, and American firms are in a position to handle all that American and European women are likely to need.

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THE AUTOMOBILE INDUSTRY

An American Art That Has Revolutionized Methods in Manufacturing and Transformed Transportation

By William Joseph Showalter

Author of "The Panama Canal," "How the World is Fed," "Industry's Greatest Asset—Steel," "Coal—Ally of American Industry," "America's Amazing Railway Traffic," etc., in the National Geographic Magazine

The following article presents a careful survey of the economic consequences of the development of the motor vehicle and a layman's impressions of the highly technical automobile manufacturing industry. The latter were gained during months of observation and inspection in the largest automobile factories in America, under the guidance of automotive engineers and manufacturing superintendents.—The Editor.

WITH thirteen million motor cars and trucks now running on the roads of the United States, and with the annual demand for new ones in excess of three millions, America is both literally and figuratively "stepping on the gas" in the making of transportation history.

A quarter of a century has brought a development in the automobile industry that has outrun the dreamers, confounded the prophets, and amazed the world.

In 1898 there was one car in operation for every eighteen thousand people, each of them a hybrid creation secured by crossing a bicycle with a buggy, and installing in the product a noisy, sputtering little engine that startled the people in the streets and sent the horses on the highways into panic (see pages 348 and 349).

To-day there is one motor vehicle to every eight people, and the worst of them is a marvel of silence and service as compared with the best of its early predecessors.

Thirteen million motor cars! Who can visualize them! Five for every freight and passenger car on all the railroads of the United States! Enough to carry half the people of America in a single caravan!

The Lincoln Highway, from the banks of the Hudson to the Golden Gate, is 3,305 miles long. To put them all on that highway, even in traffic-jam formation, would require that it be widened so that fifteen cars could stand abreast!

ROUND TRIP TO THE SUN EVERY 21 HOURS

The service they render is proportionately large. Assuming that the average car is operated only ten months in a year and runs only twenty miles a day, their aggregate travel amounts to seventy-eight billion miles annually.

Such a mileage figure being so vast, we might conclude that ten months a year

TEN OF A KIND TAKING THE TWIN PEAKS' GRADE ON HIGH AT SAN FRANCISCO

A San Francisco distributer decided to show the world what his cars could do on heart-breaking hills. Ten owners, one a woman, came to the scratch at the foot of the hill and not a gear was shifted after the start. The power of the American-built motor represents an outstanding engineering achievement.

Photograph from N. L. Drew

DRIFTING DOWN THE MOUNTAIN SIDE ON THE PIKES PEAK HIGHWAY

In no other way is the relegation of the horse from the streets and highways of the country more strikingly attested than in the decadence of the horse-drawn-vehicle industry. In 1914 the output of horse-drawn vehicles was valued at $131,000,000. In 1921 it had declined to $42,000,000—a slump of 67.8 per cent in seven years.

© Major Hamilton Maxwell

A SECTION OF THE STORM KING HIGHWAY BETWEEN CORNWALL AND WEST POINT, NEW YORK

It is such scenery as this that has drawn millions of motorists and their families into the great American out-of-doors and brought rejuvenation to tired nerves and sluggish bodies.

A PICTURESQUE PIECE OF ROAD-BUILDING ON SIGNAL MOUNTAIN, TENNESSEE

and twenty miles a day overestimated the average car's performance, but both gas and tire data tend to justify an even greater mileage.

It is estimated that the gas consumption by the motor cars of the country will exceed six billion gallons this year. It is generally held that, taking every type of car, the average driver is able to coax fifteen miles out of each gallon of gas he puts into his tank. But even on the basis of thirteen miles per gallon, a little arithmetic gives the enormous total mentioned above.

It is also believed that the average tire, fabrics and cords, delivers more than 8,000 miles of service. On the basis of the number of tires put on automotive wheels annually, the aggregate motor-car mileage would be eighty billions.

Three times as many motor-miles on the highways as car-miles on the railways is a marvelous record for so youthful a competitor of rail transportation.

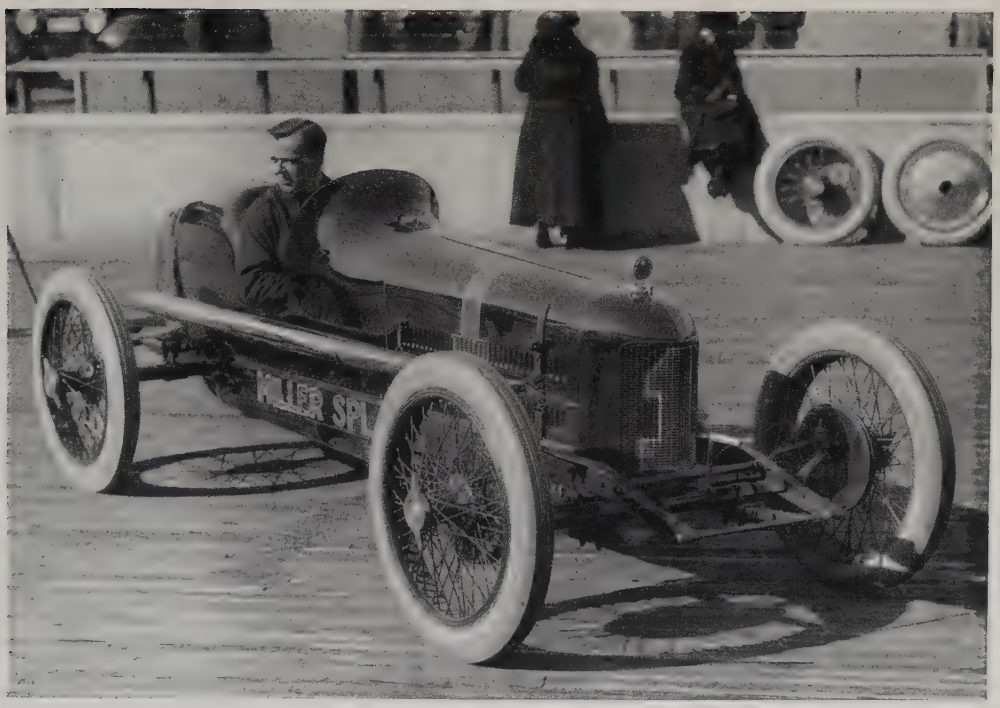
Counts at the New York City ferries and elsewhere indicate that the average car carries 2½ passengers. This means that more than thirty million people take to automotive wheels every day, or more than nine billion annually—eight times as many as are carried by all the railroads.

The transformation in the lives of the people which these figures indicate stands almost, if not quite, unparalleled in any quarter of a century of human existence.

Starting out as a plaything, transformed into a luxury, and then becoming, in turn, a definite element in our standard of living, the motor vehicle has assumed the rôle of a highly efficient factor in our

MOTORING THROUGH THE FAMOUS WAWONA TUNNEL TREE, MARIPOSA GROVE, CALIFORNIA

When Carl G. Fisher suggested the Lincoln Highway and Henry B. Joy sponsored it, they started a development that has done a vast service in opening up the national parks to the American motoring public and to the general cause of good roads. Roy D. Chapin followed their lead and established a scholarship in highway engineering at the University of Michigan—an idea that other universities have adopted.



Photograph by Pacific and Atlantic Service

A POWER MACHINE OF THE FIRST MAGNITUDE: A PRESENT-DAY TYPE OF RACING CAR READY FOR THE BIG RUN

Many of the racing cars are one-man vehicles, with a cockpit into which the driver can crouch in the event of a mishap. In some cars a sector is eliminated from the steering wheel rim to enable the driver to get his body completely into the cockpit, in the event the car rolls over.

transportation system, touching the lives and promoting the welfare of America as few developments in the history of any nation have done.

TRANSPORTATION THE LADDER OF CIVILIZATION

Transportation, some one has well said, has been the ladder upon which humanity climbed from a condition of primitive life to that of a finely wrought and complex civilization.

As the number of automobiles has grown, the wealth of the country has increased. In 1909 we had less than three hundred thousand motor vehicles in commission and the national income amounted to less than twenty-nine billion dollars. To-day, with our thirteen million registered vehicles, the national income is around sixty billion dollars.

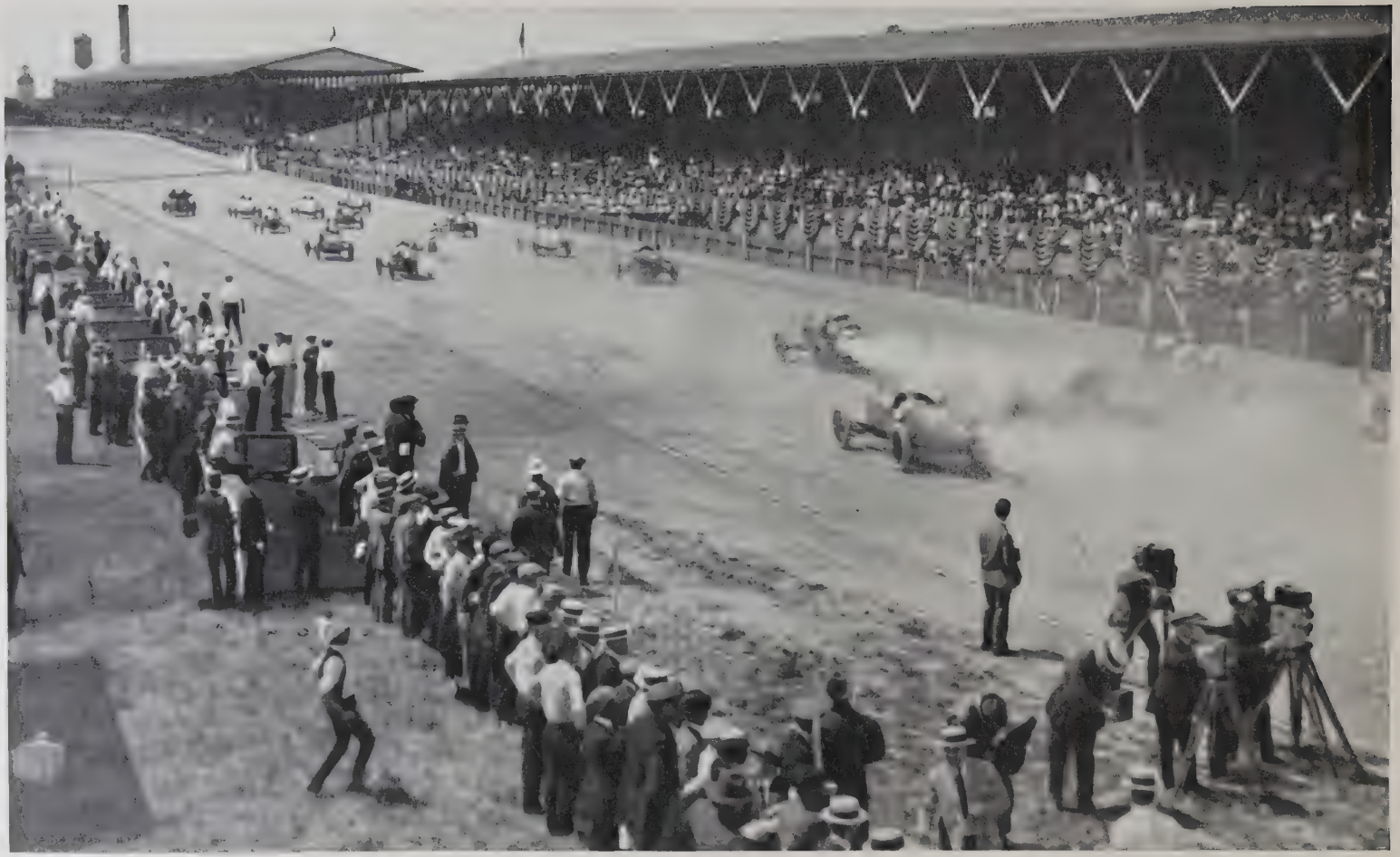
Although we are, as a nation, according to Moody, the statistician, spending more for our automobile service than is being spent for railroad transportation, shelter, or heat and light—more, indeed, than for any other item in our national budget except clothing and meats—our savings-bank deposits and every other index of economic well-being tell the same story of the growth of our national wealth.

Economic readjustments are taking place on a major scale, and with increasing momentum, under the irresistible impact of automotive mileage.

Cities are spreading out. Long Island is built up for half its length to accommodate those who make New York the metropolis of America; so is New Jersey from Morristown to Long Branch and from Jersey City to the Empire State boundary at Suffern. Even Connecticut, as far as Stamford, Greenwich, and New Canaan, is peopled with those who work in Gotham by day and sleep in the country by night.

THE LINE-UP AT THE START OF THE SPEEDWAY 500-MILE TEST AT INDIANAPOLIS

"These terrific tests have always brought the engineering talent of the country together. Under the lessons learned there, cylinder displacement has been reduced, fuel economy has been evolved, and safety has been forged into every element of your car and mine, on the mighty anvil of a speedway and under the powerful hammer of high speed. Harmony, balance, dependability, tire mileage, and sturdiness have come from the flaming forge of a hundred miles an hour" (see text, page 384)



DOWN THE STRETCH WITH THROTTLES WIDE OPEN

No phase of motor-car development has brought more comfort to the car-owner than the evolution of tire dependability. In the big speedway races there is an amazing amount of skidding around the turns, and tires simply had to be improved to stand the grind. The long life that every motorist now finds in high-grade tires grew out of lessons learned in these grueling races.

Photograph by Paul Thompson

THE START OF THE HARKNESS TROPHY RACE AT THE SHEEPSHEAD BAY SPEEDWAY, NEW YORK

Where once the kings and queens of the turf thrilled the multitudes with the fleetness of horse flesh, now the finest creations of the automotive engineer's art flash around the course at a hundred miles an hour.

Chicago has the same story to tell, with its scores of consequential colonies, its dozens of outlying subdivisions. Philadelphia and San Francisco are but other examples of how men are coming to work in town and live in the country.

Not only in a residential way are cities undergoing a change, but also in a business way. The trek of branch banks far out beyond the business district is but one straw showing the direction of the transportation wind. The lack of parking space down town is making an ever-widening business district and new centers of commercial activity in every major urban community. The era of down-town crowding is forcing the future to change radically our orthodox type of commercial concentration.

EVER-BROADENING RURAL HORIZONS

A similar transition is occurring on the farm. No longer are the farmer's children isolated. They can find their diversion in the pleasures of urban life after the day's rural tasks are done.

High schools are spreading out through the rural districts, and the general substitution of systematic secondary education for the little red schoolhouse type of training is of vast moment to America.

Rural horizons are being pushed back.

The twenty miles that once represented a day's journey in the farmer's little world are now less than an hour's spin.

The broadening experience that travel brings; the development of judgment and decision that automobile driving requires; the spread of mechanical knowledge that car maintenance entails; the demand for initiative and enterprise in those who would own and operate an automobile, are giving to the American people a training the value of which cannot be estimated in dollars and cents.

Many a wise leader of industry has sensed the significance of car ownership by his employees, and is encouraging them to buy homes where houses are detached and where they can own cars. The president of the Baldwin Locomotive Works has told his men that he wants all of them to have initiative enough to own cars.

ELEVEN OUT OF EVERY THIRTEEN MOTOR CARS IN THE WORLD REGISTERED HERE

What people could appreciate and capitalize the advantage of the motor car so well as those of America? Their wealth is more widely distributed than that of any other nation; their average income is equaled nowhere else on the planet; furthermore, they have an unexcelled genius for quantity production. It is these facts that are responsible for eleven out of every thirteen motor vehicles in the world being operated on American roads, and for twelve out of every thirteen produced in a given period being Yankee-made.

Surveying motor-car registration, we find that South Carolina has more cars than Australia or Argentina; that Kansas has more than France or Germany; that Michigan has more than Great Britain and Ireland.

Indeed, New York, Pennsylvania, New Jersey, and Maryland, with a combined population smaller than Poland, and with an aggregate area more limited than New Mexico, have more automobiles in service than the whole world outside of the United States.

Even the District of Columbia has more motor vehicles than Austria, Belgium, Brazil, South Africa, China, Cuba, Czechoslovakia, Denmark, India, Japan,

AT THE END OF THE TRAIL: GLACIER POINT, YOSEMITE PARK, CALIFORNIA

Through the automobile, the American people have broken the bonds that formerly tied them to narrow localities.

Photograph by Brown Brothers

A CROSS BETWEEN A BICYCLE AND A BUGGY, IN THE EARLY DAYS OF THE AUTOMOTIVE INDUSTRY

Haynes, Ford, Duryea, Winton, Olds, and Apperson are names that will live as the founders of a vast industry who builded better than they knew.

Jugo-Slavia, Mexico, The Netherlands, New Zealand, Norway, Poland, Portugal, Rumania, Russia, Spain, Sweden, or Switzerland.

In a group of twenty-eight major cities of the country, there are more cars stolen annually, even, than are used in Austria, Belgium, Japan, or Mexico.

The insatiable demand for new cars, in spite of the tremendous number already in service, is disclosed by the fact that many more will be called into commission this year than were built from the birth of the industry up to the end of 1915.

Available figures indicate that the total car sales for the year will approximate five millions, including two million used vehicles. This means that one family out of every four in the country annually figures in an automobile transaction.

WHEN WILL THE POINT OF SATURATION BE REACHED?

With such facts before them, men naturally pause and wonder how it can be that the long anticipated "point of saturation"—that is, the hour when the country's demand for new cars will be limited to replacements—is not reached.

Photograph by Brown Brothers

A ROPE-TIRED HYDROCARBON CARRIAGE OF THE 1899 TYPE

When Charles Goodyear accidentally dropped a lump of his rubber compound on a hot stove, he little dreamed of the forty million cord and fabric tires that would annually rise out of his discovery, or of the motor-car industry made possible thereby.

All the economists have been predicting its arrival for years. A decade and a half ago it was learnedly urged that the wealth of the country could never support more than two hundred thousand new cars a year. A little later it was being said that when the registration reached the five-million mark it would slow down to the slight annual increase required for the growth in population.

But that mark was passed and the expansion continued, with ten millions as the limit beyond which it seemed impossible to go. To-day that limit has been exceeded and there are once more many considerations which would seem to indicate that the "point of saturation" is close at hand. Car registration is now up to the point where it is only a million behind the telephone listings of the country, only seven millions behind the total number of families, and even closer than that to the total number of dwellings.

Yet contrary to these considerations, and in spite of the warning from financiers that many people who can't afford them are buying cars, and in the face of the additional fact that 70 per cent of the cars being sold are bought on the deferred-payment plan, the demand goes on unchecked except as affected by seasonal conditions.

A study of Uncle Sam's expense account for motor-car transportation shows that it totals seven billion dollars annually. Men naturally wonder how we can go far beyond that, but they forget that for every dollar added to our national automobile transportation expenses we add several dollars to our national income.

WHO CAN AFFORD AN AUTOMOBILE?

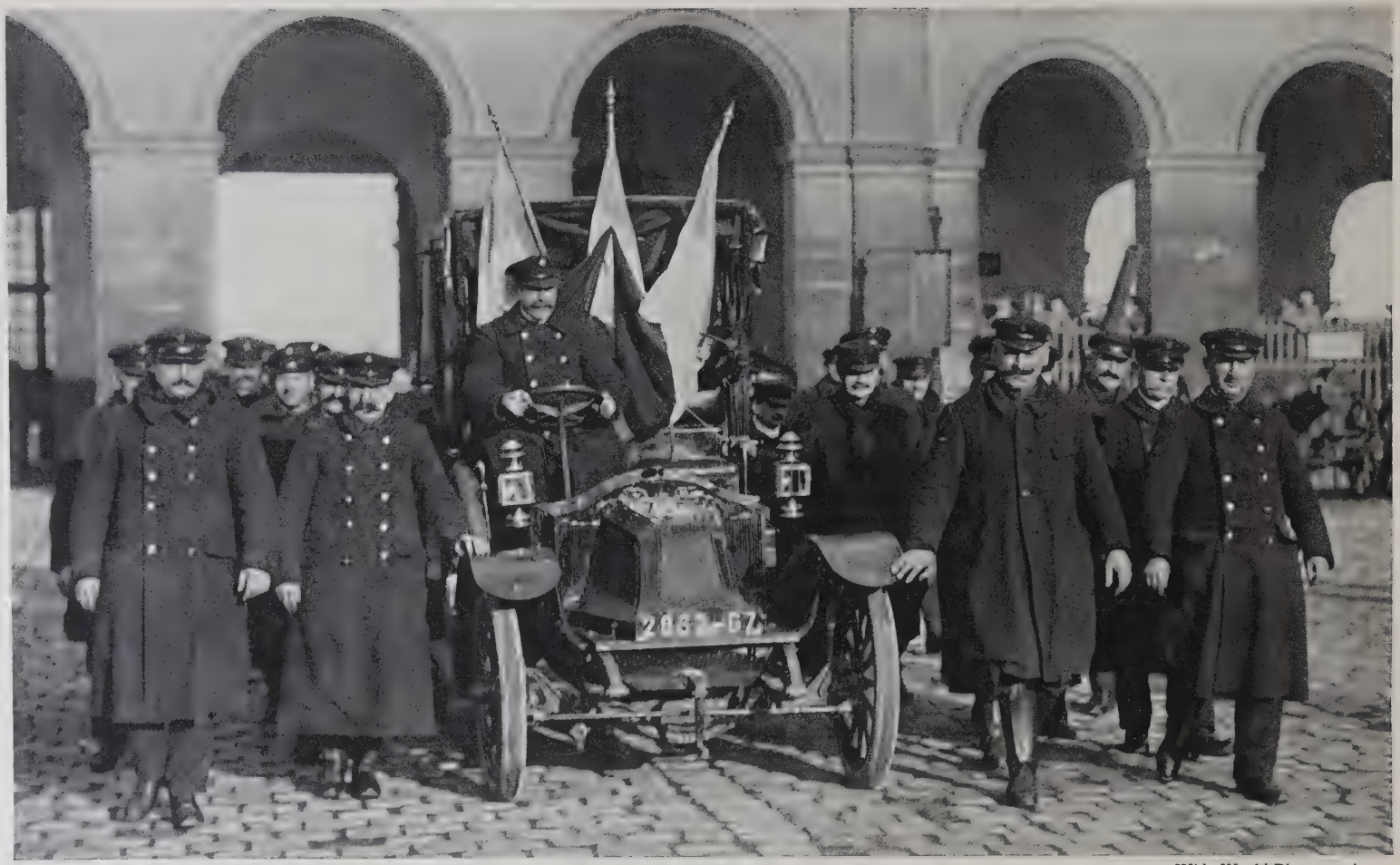
An old-time, long-headed man in the automobile industry has a theory that seems to be the answer to the issue of who can afford to buy a car.

"I get tremendously tired of all this talk about this man and that man not being able to support an automobile," said he. "It's just like the question of whether a given man can afford to get married or

Photograph by Brown Brothers

EXPERIMENTAL TRANSPORTATION TWO DECADES AGO

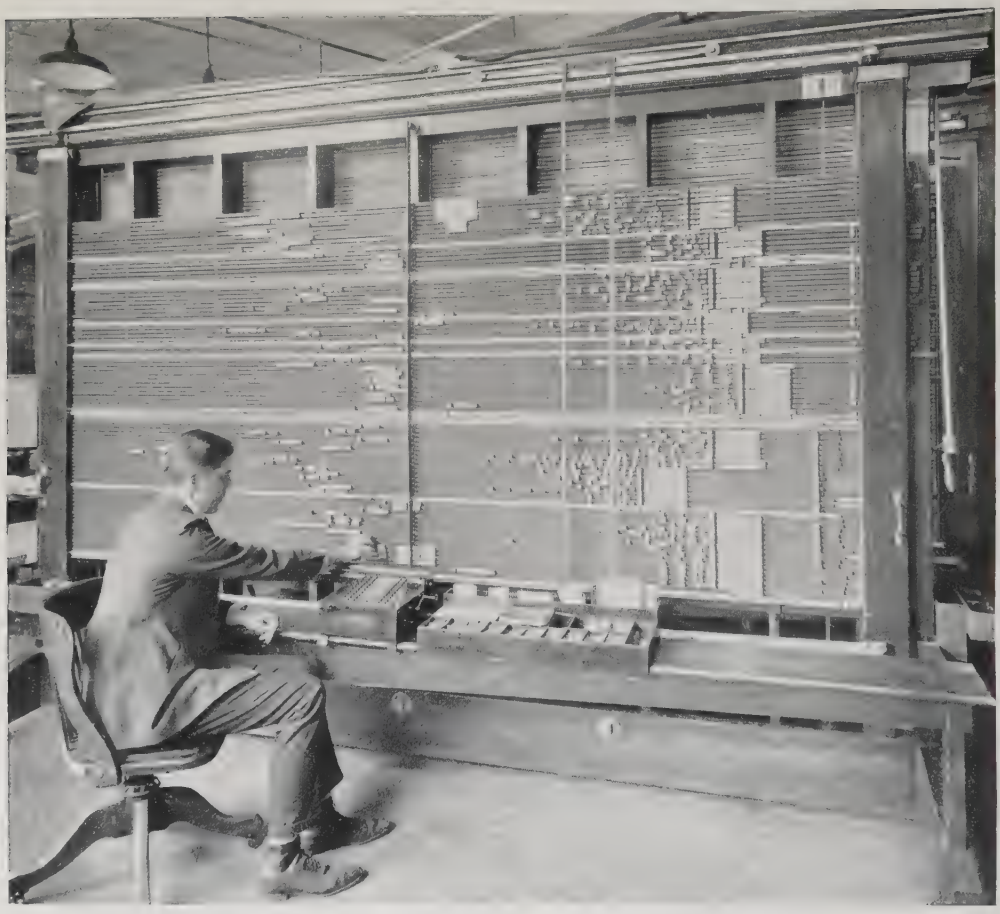
The blacksmith and the owner of a one-hoss shay survey with disdain the new-fangled machine which presumes to travel rubber-shod over rough highways. And for many seasons, before the day of perfected motor and of service station, it was the horse or the mule which pulled the new invention out of mudholes and sand beds when engine balked and tires subsided.



Wide World Photograph

ONE OF THE TAXIS THAT SAVED PARIS AT THE MARNE

This cab was recently driven to the courtyard of the Invalides, in Paris, where it is to take its place beside the railway coach in which Marshal Foch signed the Armistice.



THE DISPATCHER'S OFFICE IN AN AUTOMOBILE PLANT

These boards, in the production department of a major plant, control the passage through the factory of material and parts, bringing them together at the right time and showing the status of operations all the way through to the finished product.

not. One man, in whom only his bride has confidence, makes a success of matrimony and life. On the other hand, another man embarks on the matrimonial sea who is regarded as well fixed, and he makes a total failure of his venture."

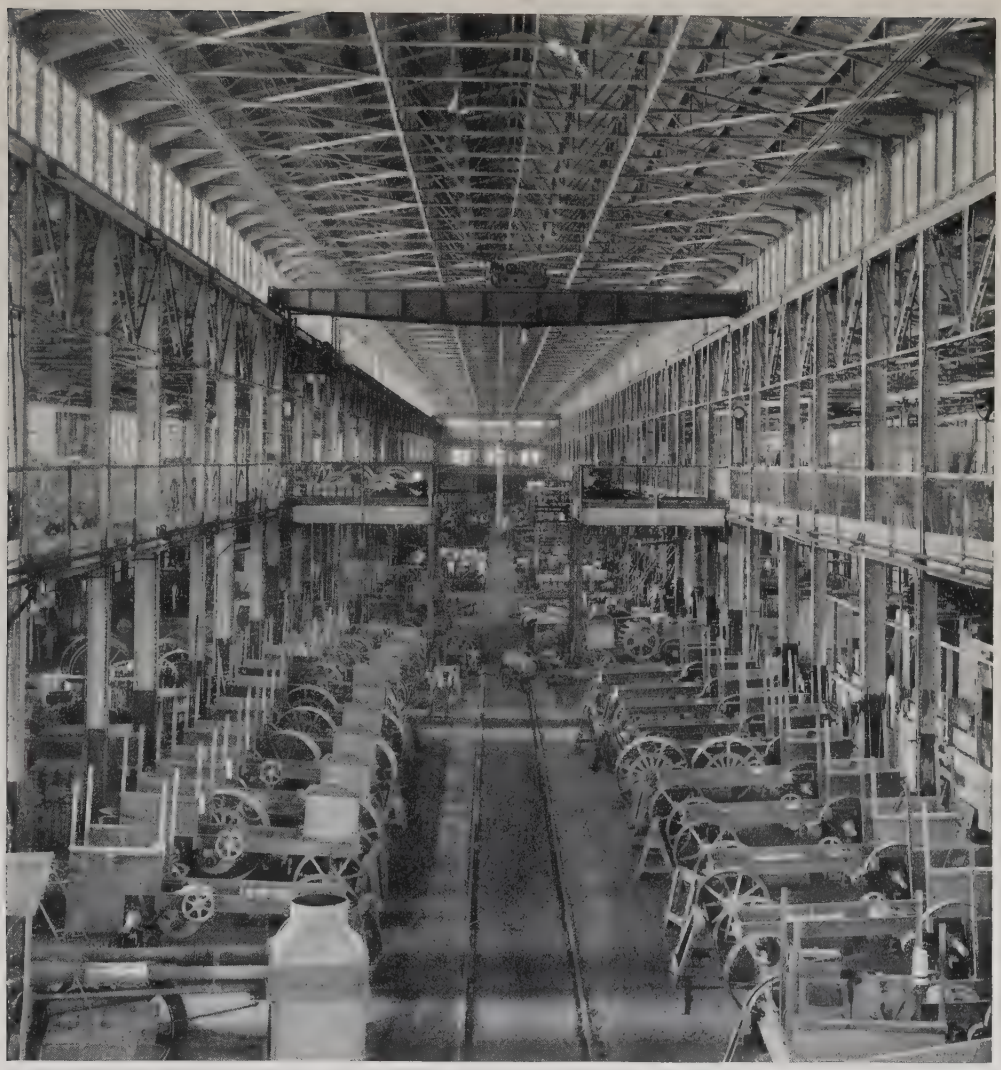
Many a man is "made" by marriage, and not a few are developed by automobile ownership. But just as matrimony enriches the nation, however much it costs in dollars and cents, so does transportation—and that is what the automobile is.

Many things are happening that promise to postpone our arrival at the "point of saturation," however much the signs indicate its nearness.

Graphs of prices and production show that price reduction has always served to widen the demand. Every fifty dollars' reduction in selling price opens up, according to the graphs, a new field of a million prospects.

The deferred-payment plan also widened the market tremendously for all cars, and now the much-discussed "five dollars down and five a week" scheme of the Ford Motor Company is enrolling hundreds of thousands of new customers.

But that plan, it seems, is not exactly what on its face it appears to be. The dealer is to use his judgment as to how many months these payments will have to continue before the customer gets his car. If the latter convinces him of his ability to go on paying, the car will be delivered after thirty weeks. Otherwise, the whole sum, even, may be required



THE INTERIOR OF THE MACHINE SHOP OF A BIG TRACTOR PLANT

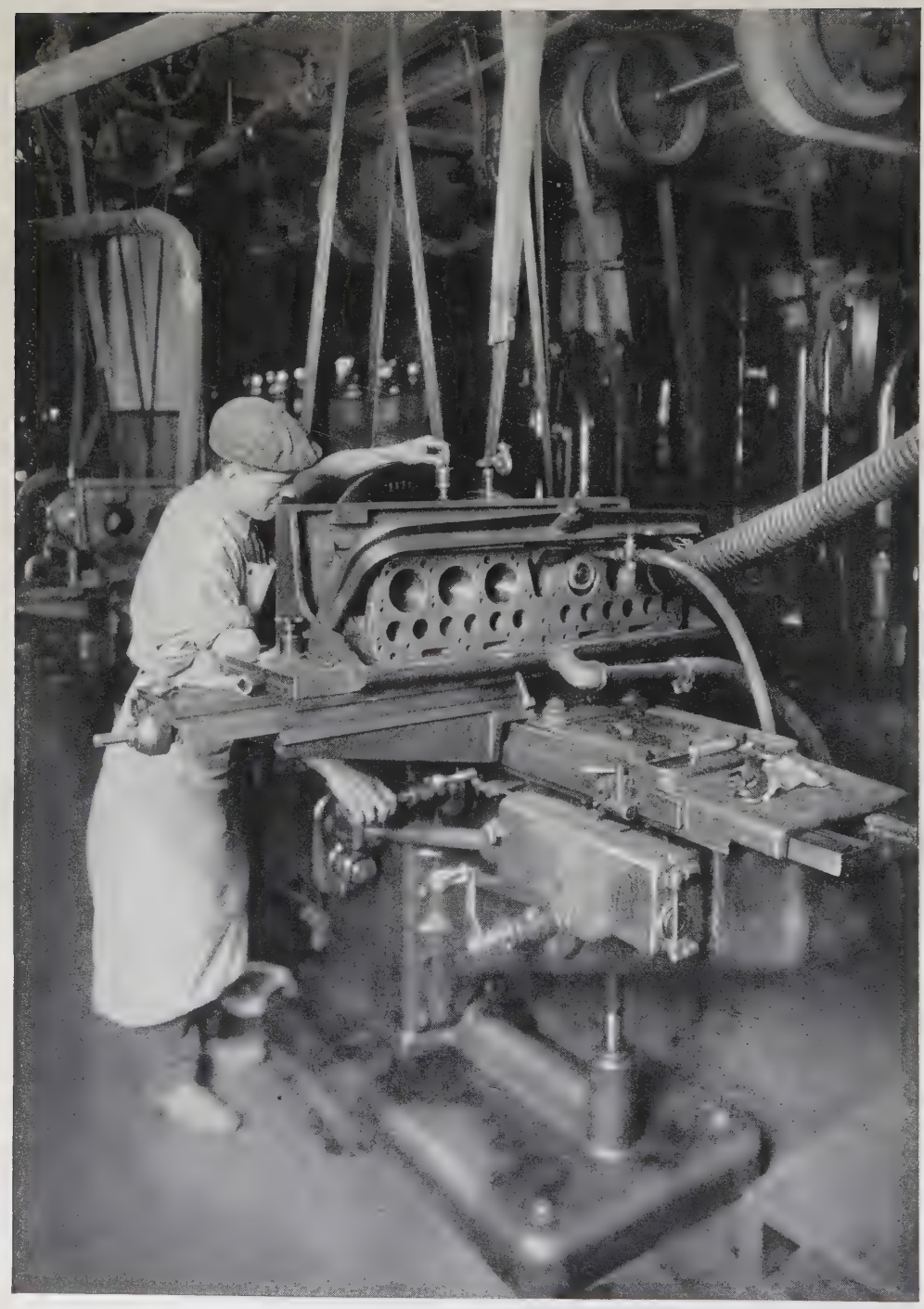
Quantity production is becoming as marked in tractor plants as in automobile factories. The Iowa State Agricultural College has found that it costs $100 a year to keep a farm horse, and that the average horse works 723 hours. A tractor will do the work of six horses, to say nothing of the human labor saved.

before delivery is made, and by that time the buyer will have had a pretty good lesson in thrift.

HUMAN EFFICIENCY AND THE AUTOMOBILE

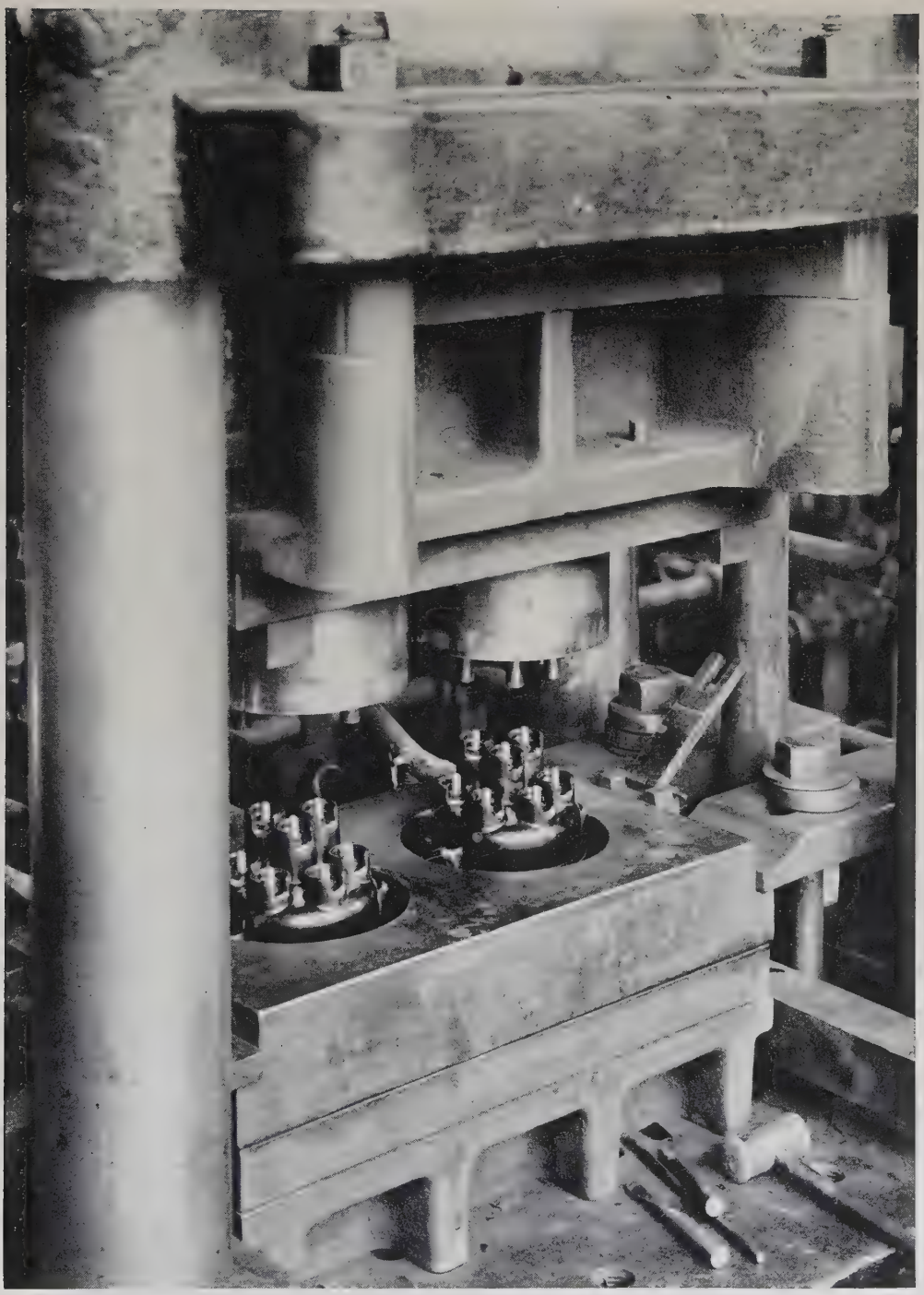
A questionnaire sent out to thousands of automobile owners at random all over the country throws some light on the specific increase in efficiency that the motor car brings to its possessor. The summing up of the answers shows a 56.7 per cent increase in working capacity. Applied to the millions of car-owners, this would represent the equivalent of adding nearly seven million new workers to the nation's productive forces.

The promotion of efficiency in those who own cars is only the beginning of the direct returns that the industry makes in balancing the tremendous expenditure for automobile transportation. It gives direct employment to more than a million men and indirect to two or three



GRINDING THE CYLINDERS OF A STANDARD "SIX" ENGINE

Each cylinder in a high-grade engine must be ground exactly true, both as to size and direction. It must not depart more than one ten-thousandth of an inch from standard size. Note the emery wheel in the fourth cylinder from the left. In a six-cylinder car, each piston makes 6,000 trips through its cylinder for every mile traveled (see text, page 366).



A PRESS FOR MOLDING BAKELITE DISTRIBUTER HEADS AND OTHER IGNITION PARTS

Bakelite is made by treating carbolic acid with formaldehyde, and comes to the automobile accessory manufacturer in a powdered form. He imbeds his terminals and other metal parts therein, and subjects it to high heat and heavy pressure, getting the fine, indestructible insulation required for his electrical parts, which do so much to reduce ignition difficulties.

Photograph from The Robbs

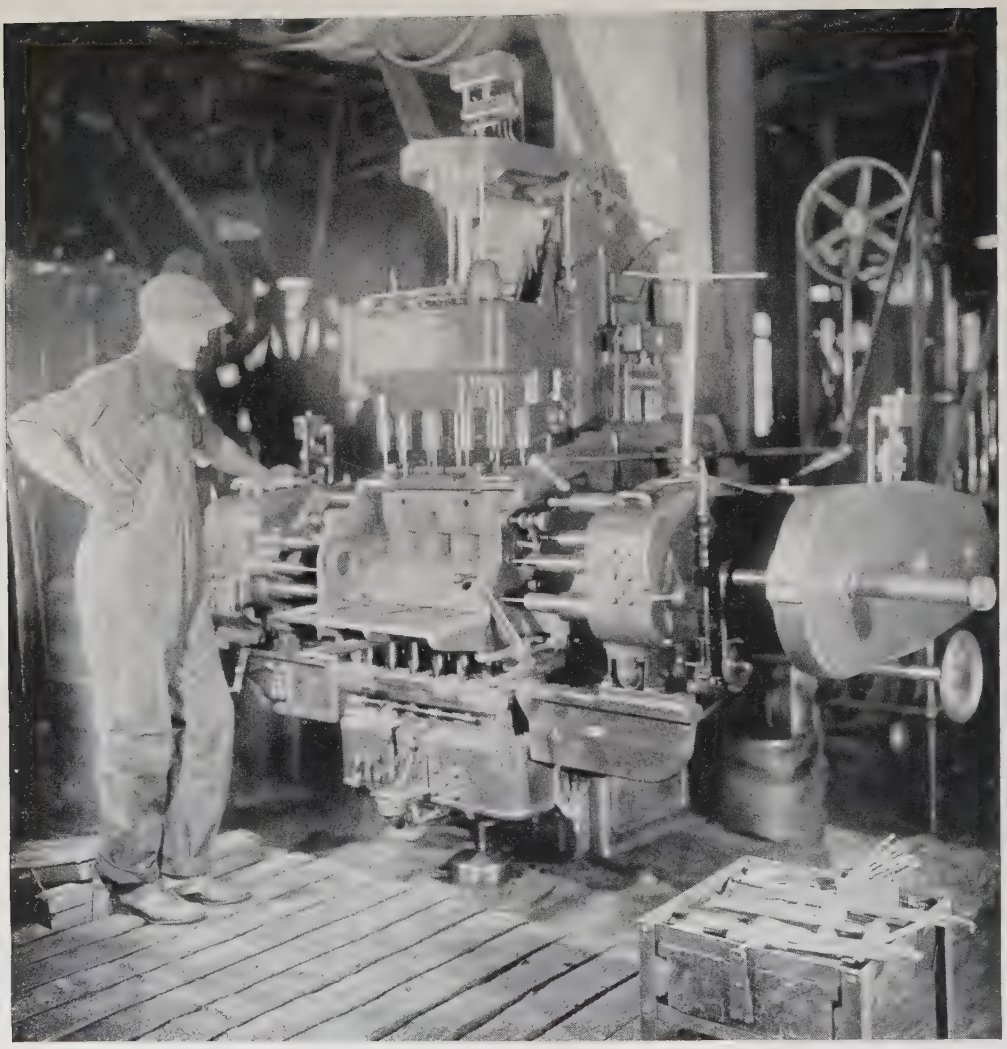
BESIDE A MOUNTAIN OF ICE CAST UPON THE SHORE OF GREEN BAY, NEAR ESCANABA, MICHIGAN

Ninety per cent of the public buy their cars from 20 per cent of the manufacturers. The other 80 per cent of the manufacturers divide the remaining 10 per cent of the sales among them. But catering to the 10 per cent who want something different means a trade worth more than half a billion dollars a year.

Photograph by F. H. Kiser

CAUGHT IN A SNOWSTORM ON THE RIM OF CRATER LAKE, OREGON

The cost of parts replacements in motor cars of the present day is surprisingly low, in spite of the high cost of installation. One major manufacturer shows that all parts sales for the year amounted to only $13 per car. This is wholesale, of course.



A BIG ENGINE-BLOCK BORING MACHINE IN OPERATION

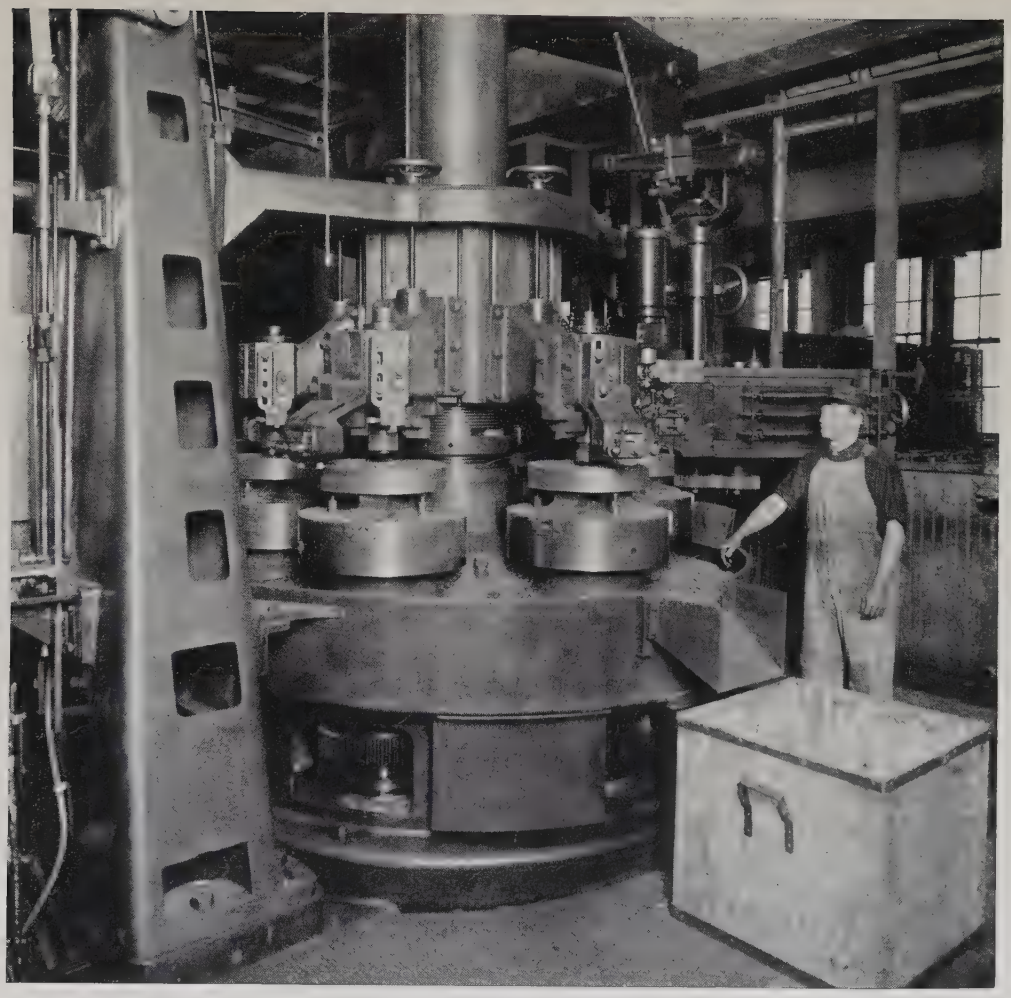
Boring some fifty holes, of various sizes and in four directions, at a single operation is typical of the methods of automobile manufacturers in reducing the cost of building cars by the elimination of unnecessary hand labor.

times as many. It buys the major portion of the country's plate glass, a vast share of its iron and steel, most of its aluminum, much of its leather. It gives the railroads much more freight to haul than it takes from them.

It has sent hundreds of thousands of people into the suburbs, where rents are cheaper and living conditions better, and where the savings in rent offset the car's maintenance costs, leaving the better living conditions as dividends.

Yet the direct contributions to national prosperity are small compared with the indirect contributions briefly referred to above—the expanding city and the narrowing countryside. What stories the rusty little cars parked around the rural high school could tell of boys and girls who will finish their secondary education, when their parents never got beyond the sixth grade!

Before the coming of the motor car, the farmer who was not up at five in the morning or who had left the field before sundown in the evening was accounted a shiftless tiller of the soil. From seven to seven in the field, with his morning



MACHINING FLYWHEELS

This machine has a whole battery of cutting apparatus which dresses up half a dozen flywheels at a time.

and evening chores before and after, was his routine.

HOME OWNERSHIP INCREASES WITH CAR REGISTRATION

That he is now released from such a grind; that his family is coming into its normal share of diversion and recreation; that he can provide his children with opportunities that fate hitherto denied him, is due mainly to the motor car and the train of advantages it has brought him. The farm bureau, the rural woman's club, the parent-teacher association, are but a few evidences of his intellectual emancipation. In Pennsylvania 65 per cent of the farmers own motor cars, and other States show similar percentages.

When will the point of saturation be reached, in the light of such direct and indirect returns, and in view of the fact that fewer deferred-payment buyers default on their cars than on household furniture; that definite statistics show home ownership increasing with motor-car registration; that national income increases as automotive transportation outgo swells?

Measured by California's present ratio of car-owners to population, it will not be reached until the present registration of the country is doubled.

WINDING ARMATURES FOR MOTOR-CAR GENERATORS

Until recently it has been necessary to wind armatures with these comparatively simple hand machines. To keep the tension uniform with the constant starting and stopping of the wire reels of the type shown in the left foreground was apparently an unsolvable problem. A new machine has just been perfected, however, which automatically winds the armatures, one girl being able to do the work of four, with none of the strain involved. The wire is drawn on a 15-pound tension.

Yet even California has not settled down to replacements. Measured by Indiana's existing ratio, the ultimate registration of the country would reach eighteen millions, but Indiana still shows herself far on the sunny side of saturation.

Those whose past predictions have been most nearly justified by the trend of events are making new predictions to-day, and these are that the point of saturation will not be economic, but rather physical. The congestion in the big cities is fast growing so great as to keep thousands of motorists out of the down-town districts.

BIG CITY TRAFFIC PROBLEMS

With all the traffic officers and signal systems, the task of handling the ever-flowing stream of motor cars and trucks grows apace. Some 42,000 motor vehicles pass the crossing at Fifth Avenue and Forty-second Street in New York every twenty-four hours; 4,500 in a single busy hour is not an unusual occurrence.

The block-signal system on Fifth Avenue, with traffic moving in a series of stops and starts, controlled from a central tower, has accomplished much, but even it is destined to prove inadequate. Boulevard traffic regulation, based on the Fifth Avenue practice, has also helped in many cities, but here again inadequacy is only a few years away.

Propositions are now coming from the foremost authorities for the establishment of express streets, where cars will move at rates of from forty to fifty miles an hour, and where gates will be established at intersections, just as at railway crossings. Commissioner Harriss, of New York, says that New York needs three north-and-south highways of this character, with traffic moving on each of them in three parallel lines in both directions. These streets, he says, will have to be four hundred feet wide and elevated in special instances.

Chicago is installing a synchronized traffic-control system similar to that now in operation in New York. This system of towers will extend south on Michigan Boulevard from Randolph Street, with the master tower at Jackson.

So great is the congestion in the famous Loop District in Chicago that proposals are being made to take all pedestrians off of the street level and to provide second-story sidewalks for them. The streets could then be widened to the building lines, almost doubling their present curb-to-curb width, and the sidewalks would be reached by stairways, ramps, and elevators. Vehicular and pedestrian traffic, each out of the way of the other, could move twice as fast as now and many times more safely.

It is pointed out that such a plan would give two display window stories instead of one, and that the thousands of people who now avoid the Loop District because of its congestion would come back to trade there, their reclaimed business being large enough to more than compensate the property owners for the cost of the change.

The day may not be so far in the distance when the horse-drawn vehicle will be legislated off the crowded city thoroughfares, to lessen congestion, just as heavy traffic has been banished from the boulevards to protect the motoring public. Likewise, the day will inevitably come when truck traffic will be separated from passenger-car traffic on the busier highways through the countryside, just as is now the case on the fine Roosevelt Boulevard out of Philadelphia.

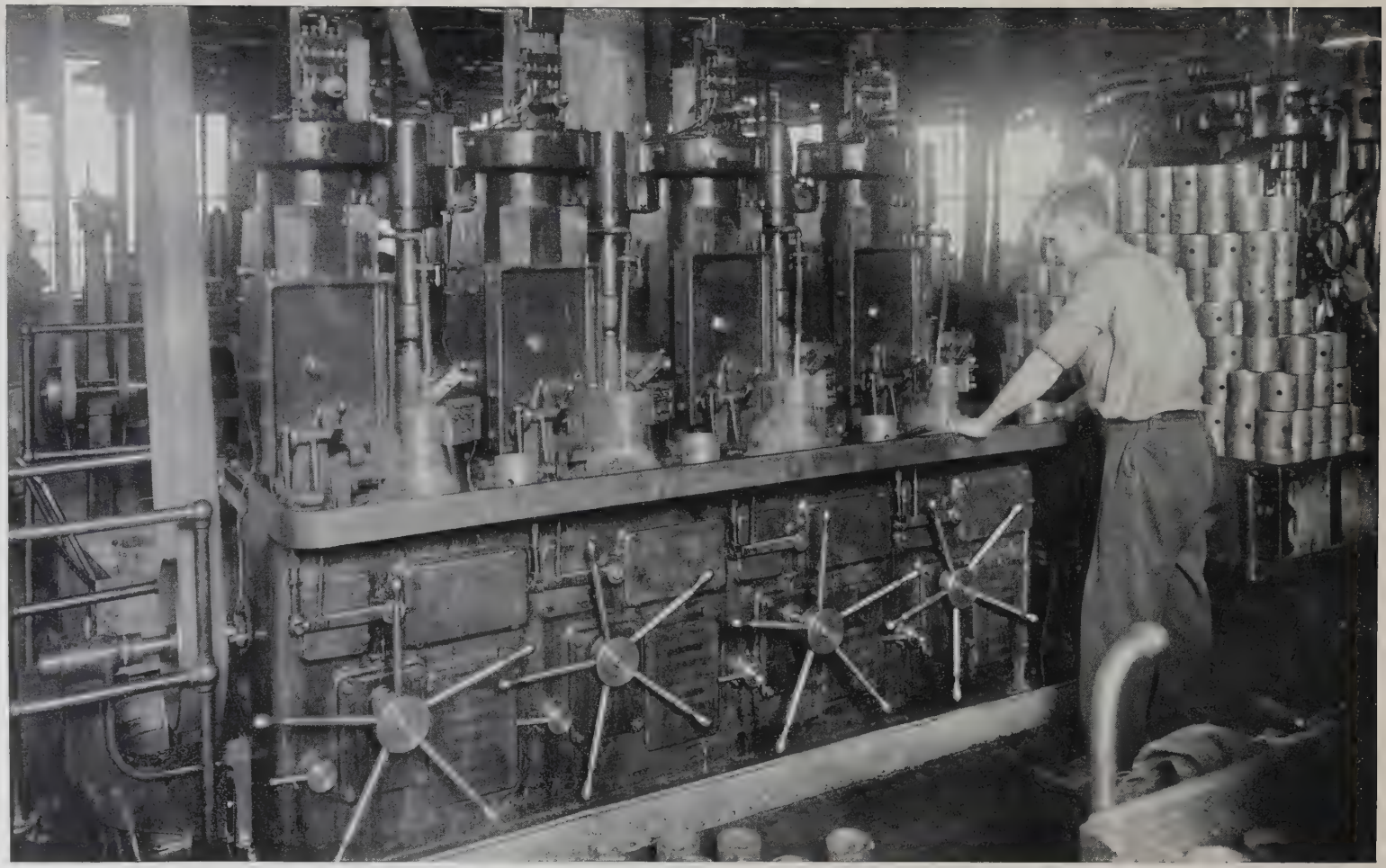
But whenever the point of saturation is reached, and by whatever route, it will not come before all manufacturing facilities available to-day will be kept busy making replacements. The average life of a motor car is six years. If 18,000,000 cars shall prove the limit, replacement requirements will call for three millions a year, which represent the present annual production.

THE AUTOMOBILE AN EFFICIENT MECHANISM

There is little wonder that the automobile has caught the imagination of the American people. A race of individualists, the sense of power to go where they will, in their own way, has a deep appeal. Further than that, a mechanically minded people, they find a thrill in the possession of a mechanism whose purring motor bowls them along the highways at a pace that exhilarates and brings a change of scene every minute. They have a sort of subconscious reverence for its mechanical merit.

AN AUTOMATIC HIDE-MEASURING MACHINE

This mechanism is able to compute instantly the square footage of a hide with all its irregularities. As the hide passes through, every square inch is automatically noted and the total registered on the dial in front of the operator.



A MACHINE THAT FINISHES FOUR PISTONS ON THE TOP AND SIDE WALLS SIMULTANEOUSLY

George Baldwin Selden, of Selden patent fame, probably lost untold millions by a simple little diary entry. His patent was applied for nearly two decades before the building of the first successful American automobile, but was not issued until years after. When he saw what is now the accepted type of four-cycle motor, he wrote, "Another of those d——d Dutch engines." On that entry the courts held he was not thinking of such an engine when he patented his vehicle, and therefore that the building of the modern motor car did not infringe his patent, although it was valid for other types of engines.

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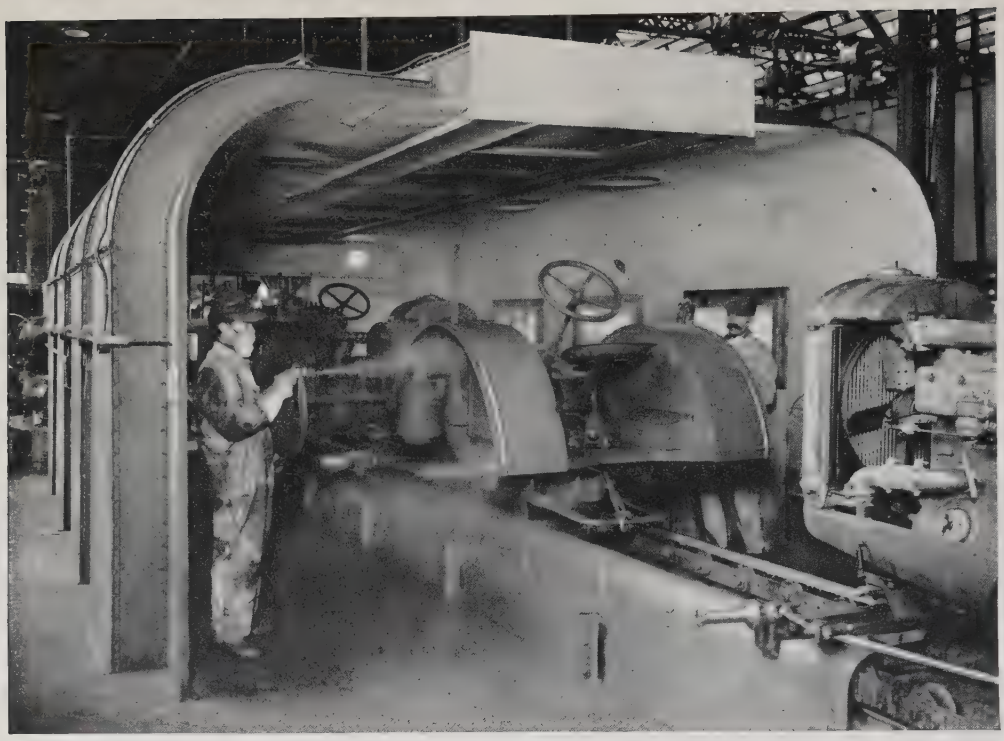
A VIEW OF CHARLES STREET, BOSTON, WITH THE COMMON ON THE RIGHT AND THE PUBLIC GARDEN ON THE LEFT

The passing of the day of putting down the tops of touring cars is to be noted wherever cars are parked.

© Ewing Galloway

MOTOR TRAFFIC ON FIFTH AVENUE, NORTH OF 42ND STREET, NEW YORK: A NORMAL SCENE AT ANY HOUR OF THE BUSINESS DAY

"Some 42,000 motor vehicles pass the crossing at Fifth Avenue and 42nd Street every twenty-four hours; 4,500 in a single busy hour is not an unusual occurrence" (see text, page 361).



PAINTING WITH COMPRESSED AIR IN A TRACTOR PLANT

By the time the tractor reaches this booth on the assembly line, everything is in place except the wheels, which are put on just beyond the paint booth. Gray paint is sprayed on by compressed air. After the wheels are put on, the line passes through a drying tunnel 110 feet long, in which the temperature is maintained at 150 degrees.

And well they may! Consider what a present-day model automobile is. Its engine might be likened to a Gatling gun capable of propelling itself a mile a minute and, if it be a "six," of firing nine thousand shots a minute in doing so, without noise, undue heat, or disturbing wear, but rather with a smooth hum or a peaceful purr that is music to the ear of the motorist. A "four," even at twenty miles per hour, fires two thousand shots a minute.

The crankshaft must do three thousand full turns in the average car to carry it a mile, and each piston must make six thousand trips through its cylinder, with a stop between each of them, in making that mile. At sixty miles you ask each valve to open, admit the live, or discharge the dead gas, and close again, in 1/200 of a second. And they are expected to do it with clockwork regularity.

The car also brings to its owner an individual light-and-power plant with which he may start his car and light his path. It gives him a clutch that lets him make or break the power between his engine and his car at will and in a twinkling; a gearshift that lets him choose between power and speed and makes the change in a moment; brakes that give him complete control of a ton and a half vehicle with a slight pressure of the foot or a light pull of the hand. It furnishes him with tires made of a rubber composition nearly three times as durable as leather and fully three times as resistant to a sand blast as iron.

Compared with any previous instrument of transportation, the automobile is a wonderful device. A railroad engine, made to run over the smoothest roadbed in the world and with comparatively slow-moving parts, must be overhauled at the end of every run. On the other hand, given gas and oil, grease and water, in proper quantities, the "trusty old bus" will hum along for two hundred miles a day,

A STAMPING PRESS THAT COMPLETES FIVE FENDERS A MINUTE

This great machine turns out 2,700 fenders per day, one fender at each stroke. So accurate is the operation that the fender requires no further finishing touches, but is ready to be enameled as soon as the pressure of 225 tons is removed.

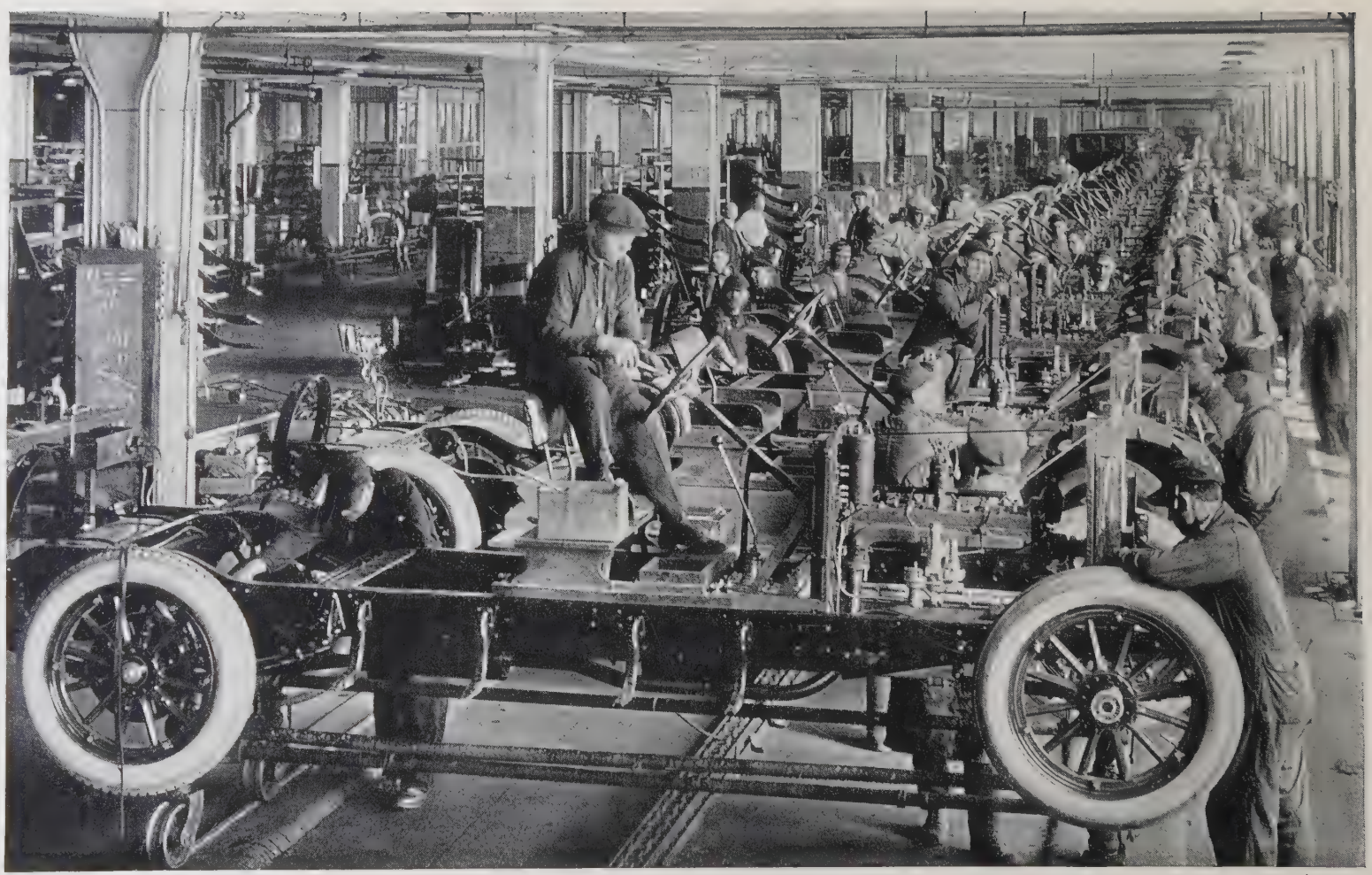
willing to give you, if it is a "six," more than half a million flywheel revolutions, nearly two million sparks, and more than seven million piston stops and starts, and be ready to repeat the performance on the morrow and many other morrows.

PROBLEMS THAT REMAIN TO BE SOLVED

Yet, far as our automotive engineers have gone in making a dependable, foolproof, vibration-defying, long-lasting motor car, they realize that much distance remains yet to be traveled before the goal of excellence they are striving for can be reached.

To begin with, our engines to-day deliver us only ten cents' worth of power for every dollar's worth of gas they burn. Their pistons must travel twenty inches, on the basis of one explosion to every four strokes, to deliver five inches of push to their load.

Likewise, our cars ask us to move from 400 to 5,000 pounds of dead weight per person carried, depending on whether they be loaded "flivvers" or big sedans



THE FINAL ASSEMBLY LINE IN A BIG AUTOMOBILE FACTORY

When cars were first built, all the parts were simply dumped in piles on the floor. Now a frame starts down one line, an engine block down another, a transmission and rear axle down others. When they all meet, they have each been assembled and are ready to be united into a completed chassis on the final assembly line.

FINISHING THE METAL WORK ON THE BODIES OF A QUALITY MAKE OF CAR

Such bodies as these require about a hundred days from raw material to finished product. The new steel, baked-enameled bodies go through the factory in less than two days (see text, page 373).

FACTORY TESTING OF SPEEDOMETERS

Before being packed, speedometers are given a final test for accuracy by running them at different speeds on a testing machine. This is the last of the 557 inspections given each instrument and its parts in the course of its construction.

with only the owner inside. These and other items in the present car's make-up stand as a perpetual challenge to the automotive engineer, and he is addressing himself vigorously to the task of correcting them.

RUNNING DOWN THE "KNOCK"

When cars were first made, the builders simply bored holes in blocks, put pistons in them, and had engines. They had only a general idea of what happens when a spark is applied to a compressed charge of gas in an engine cylinder. When the explosion took place under high compression, there came a knock that seriously reduced the engine's efficiency. All sorts of explanations for this knock were offered.

Then Mr. C. F. Kettering and his associates of the General Motors Research Laboratories decided to look into cylin-

ders and see what does actually happen when a spark ignites a charge of gas.

They built a glass engine, and through its walls were able to see what occurred. They found that in an explosion under high compression there is a secondary detonation whose energy waves move seventy times as fast as those of the primary explosion. It is the conflict of these two series of energy waves that makes the power-destroying "knock."

How to overcome this detonation became the next problem. The whole list of elements and compounds known to the laboratory was gone over and every one that offered any hope was tested. It was finally found that by adding tetra ethyl lead and a second compound in the proportion of about five thimblefuls to the gallon the secondary detonation was entirely avoided, and smooth running, even under the high compression beyond the control of a retarded spark, was made possible.

It has been found that the new combination makes five gallons of gasoline do the work of six, and the engineers assert that by reducing the size of the cylinder and the stroke of the piston it will be possible to produce higher-speed engines that will more than double the present mileage obtained from a gallon of gas.

On the other hand, there are engineers who say that while this will make possible the saving in gas, it will result in a corresponding wear on cylinder walls by the increased distance the pistons must travel to produce a mile of transportation.

The reduction of weight in cars is a very important item in the future plans of automobile design. One noted manufacturer says that unnecessary weight is as useless in a car as a cockade on a coachman's hat, if not more so, since the cockade at least serves the purpose of identification. The reduction of weight means smaller motors, lighter axles, and less cumbersome frames and running gear, all of which promise less expensive tires and decreasing operating costs.

OVERCOMING THE NECESSITY OF WATER-COOLING

One of the new departures in engine design that serves to reduce weight is the substitution of copper-cooling for water-cooling. The function of water in an automobile engine is to carry the heat from the cylinders to the radiator cells, where it is released by radiation.

For a long time, at least one manufacturer has been able to produce an air-cooled engine, with iron fins surrounding the cylinders, that has stood up well in every-day service. The engineering textbooks all declare that it is impossible to fuse copper and iron in a commercial way. However, at least two manufacturers have succeeded in doing so, and two cars are now on the market with copper cylinder jackets which claim to give radiation efficiency fully up to the standard of the modern water-cooled system.

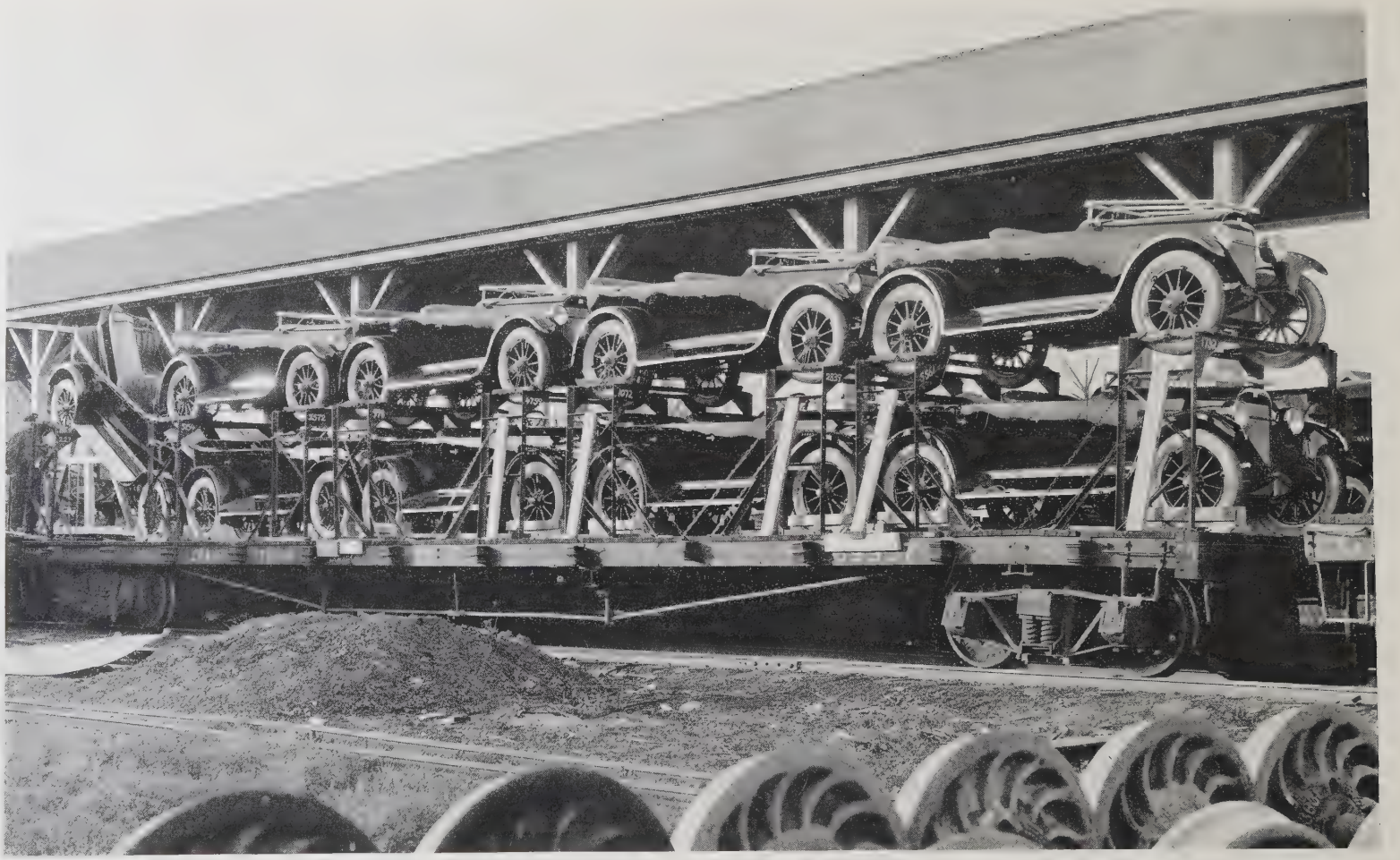
Copper, being much more efficient as a heat-radiating medium than iron, makes an ideal substitute for water, eliminating radiator repairs, freezing dangers, etc. The copper-cooled engine weighs less by about 130 pounds than a water-cooled engine of similar horsepower and cooling efficiency.

ANTI-FRICTION BEARINGS

One of the prime causes of short life in motor cars is neglect in the matter of lubrication. Owners of fleets of cars, notably some of the taxicab companies, get from 200,000 to 300,000 miles out of a machine. The owner of an individual car considers that he has done well when his odometer registers 50,000 miles. His neglect of lubrication is more frequently responsible than any other one item for his low mileage.

The General Motors Research Corporation has been working on the task of producing a nonfriction bearing, and demonstrations at Dayton point to complete success. Instead of melting the metal and molding the molten fluid, it is powdered, put into the mold in that form, and subjected to heat. The alloy has a lower melting point than the steel itself and thus is made a homogeneous part of the material. When taken out of the furnace, the bearing has a certain porosity not present in bearings molded in the orthodox manner. It is capable of absorbing a certain percentage of its weight in lubricants.

Under dynamometer tests these bearings have been run at 2,000 revolutions per minute, which is equivalent to a speed of the crankshaft of a car running 40 miles



DOUBLE-DECKING FLAT FREIGHT CARS FOR BIG MOTOR-CAR SHIPMENTS

Despite the fact that a third of a million carloads of cars were shipped from factories last year, and 75,000 more from assembling plants, and still other thousands by Great Lake steamers, it has been necessary to send many cars to distribution centers in drive-away fleets. One manufacturer maintains a corps of drive-away men, sending the cars out in fleets of ten, each with a captain and a mechanic. Drivers are not allowed to raise the hoods of their cars and must keep their assigned positions in the fleet. The speed is held down to 25 miles an hour.

an hour. Although told that they had been running for 3,600 and 3,700 hours without stop, they were still cool enough for me to bear my hand on them when I examined them.

With frictionless bearings, burned-out bushings will probably be a thing of the past. The antifriction element in them will be used mainly to counteract neglect. It will be the savings-account funds of car operation—not to be drawn on except in emergency.

THE STATUS OF STEEL BODIES

Engineers predict that the automobile bodies of the future in all quantity-production cars will be steel. Not only does metal construction reduce the time required for the completion of a sedan body from more than one hundred days to less than two, but it also makes a more lasting job.

Instead of glue and screws with which a wooden body is put together, electric welding and rivets are used, which make for permanency. It is the difference between the modern all-steel Pullman car and the old-fashioned coach of wood construction.

Baked-on enamel, applied in a few hours, if correctly put on, shows much more durability than the best hand-painting, which requires eighteen days or more. The enamel does not deteriorate, but, owing to atmospheric and temperature conditions, merely collects a residue of blue scum that is readily removed with a proper polish. A report of an enamel job done in 1914 was made at a recent meeting of a branch of the Society of Automotive Engineers. Good care had been taken of the car; it had been polished and kept clean, and in 1922 appeared practically as new.

MEETING THE DEMAND FOR ACCESSIBILITY

The motorist of the future will demand accessibility of parts. The important thing with taxicab companies is the keeping of their vehicles out of the shop and in the streets. Therefore, accessibility of parts is a sort of religion with the leading manufacturers of taxicabs.

Bolts and nuts must be so located as to insure ease and rapidity in removal or installation, and parts must be quickly exchangeable.

So thoroughly has the construction of a standard type of cab been simplified that twenty minutes is now the time allowed for the replacing of a spring, forty minutes for the removal of an engine, and fifty minutes for the reinstallation of an engine.

The introduction of the flat rate in service charges, whereby each operation is done at a factory-fixed rate, is destined to hasten the simplification of car design, for the manufacturer who can make a car simpler for the repair man than his competitor can give a lower rate for service, and this will be one of the standards by which the future buyer will determine who will make his next car.

A leading taxicab manufacturing company, with its vast fleet of cars in operation and its detailed cost-keeping system for car operation, is doing much to guide the industry toward the production of cars whose maintenance costs will be lower.

THE ADVANTAGES OF SUPER-SIZED TIRES

It has been found that vibration is the worst enemy of an automobile, and this evil has been attacked from many angles.

One line of investigation has been in the reduction of tire-inflation pressure. In pursuing this investigation it has been found that by the further extension of the oversized tire principle, inflation can be reduced from the sixty or eighty pounds pressure to thirty and forty pounds.

One taxicab company is having tires made with wider treads. This has been carried so far that some of the tires look like big, fat sausages. But the reduction of vibration due to their softness has shown amazing results in cost of car upkeep and even in car life. The tires are built with thinner walls, and through their ability to take the minor shocks of the road more easily, their mileage is lengthened to such a degree as to compensate for their higher cost, leaving both the car protection and ridability as dividends on the investment.

Skidding is reduced to a minimum with these super-sized tires, brake control is made more complete, and muddy roads are robbed of many of their terrors. Steering is not noticeably more difficult at ordinary speeds, though admittedly

Photograph from F. C. Doig

THE LAKE CRESCENT ROAD, AMONG THE FINE FIRS OF THE STATE OF WASHINGTON

A proposition is now being advocated to give the North Coast people a bridge entrance into San Francisco. A territory as large as the State of Rhode Island would thus be thrown open to settlement. It is proposed to charge a bridge toll of $1.18 per car and 15 cents per passenger or pedestrian. The bridge would be about 7,500 feet long. In 1921, 200,000 cars were handled on the Golden Gate ferry.

Photograph from De Witt V. Hutchings

ARRIVING BY MOTOR FOR THE RUBIDOUX EASTER SERVICE, RIVERSIDE, CALIFORNIA

it is somewhat harder at slow speeds, as is the turning of the front wheels when the car is standing still.

The coming of the super-sized tire will result in a smaller wheel—a wheel, indeed, not much larger than some of the brake drums now in use. It may mean a slight lengthening of the axles in order to maintain the present turning radius, though, on the other hand, it may be decided to concede a little in turning radius in order to maintain the present axle-length.

FOUR-WHEEL BRAKES A NEW DEPARTURE

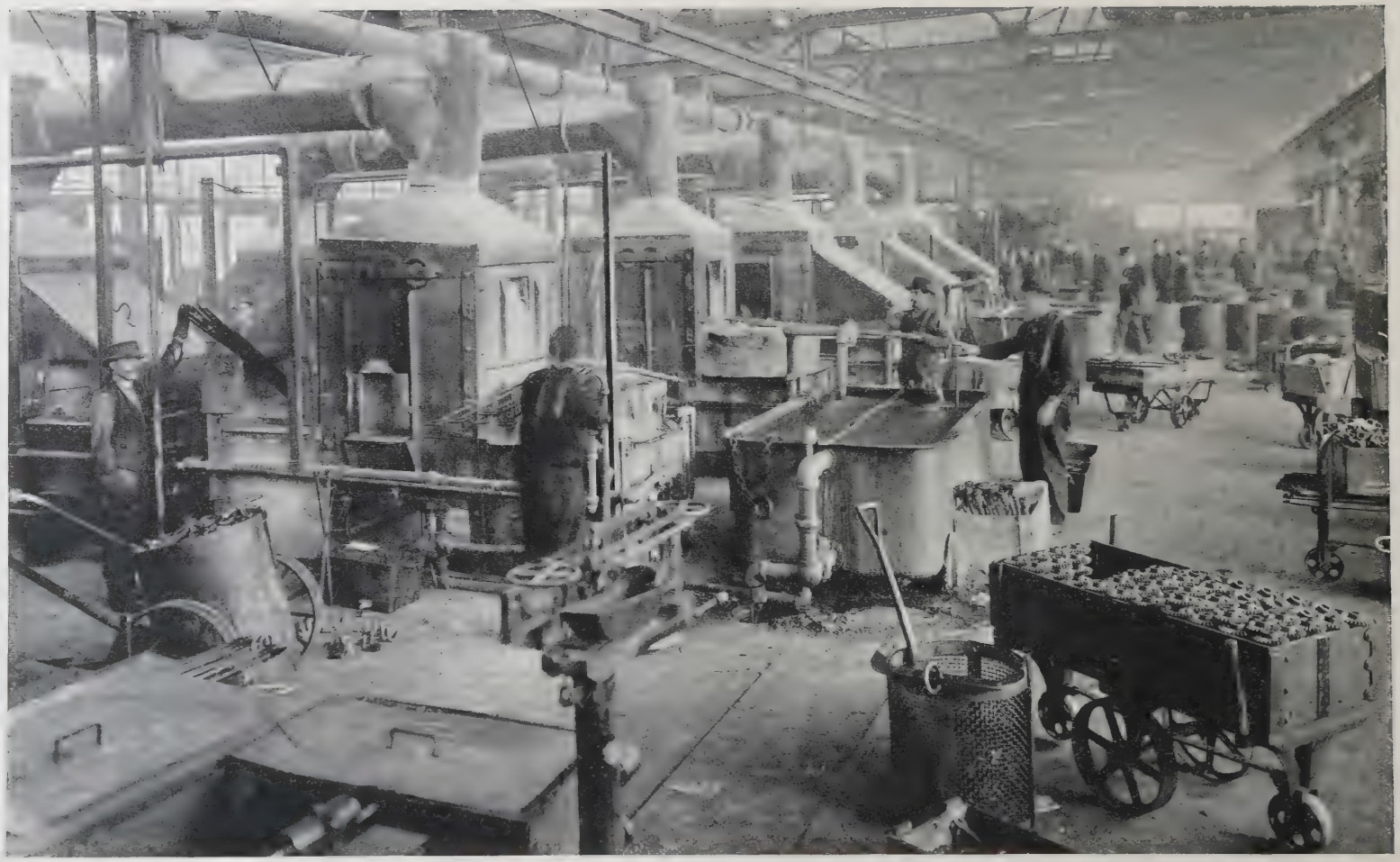
With the increasing use of automobiles increased control of the individual car is demanded. To be able to bring a car more quickly to a standstill sometimes means the avoidance of an accident. Four-wheel brakes are beginning to make their appearance in this country, and have been found to cut practically in half the distance required for bringing a moving car to a stop. Many manufacturers believe, however, that the super-sized tires will give the requisite braking efficiency without resorting to four-wheel brakes.

WHO SETS THE FASHIONS IN MOTOR-CAR DESIGN?

Automotive engineers are giving more and more attention to what they call the passenger accommodations — everything above the chassis. While the body and its accessories have little to do with the mechanical merit of the car, they have a vast deal to do with the sale demand.

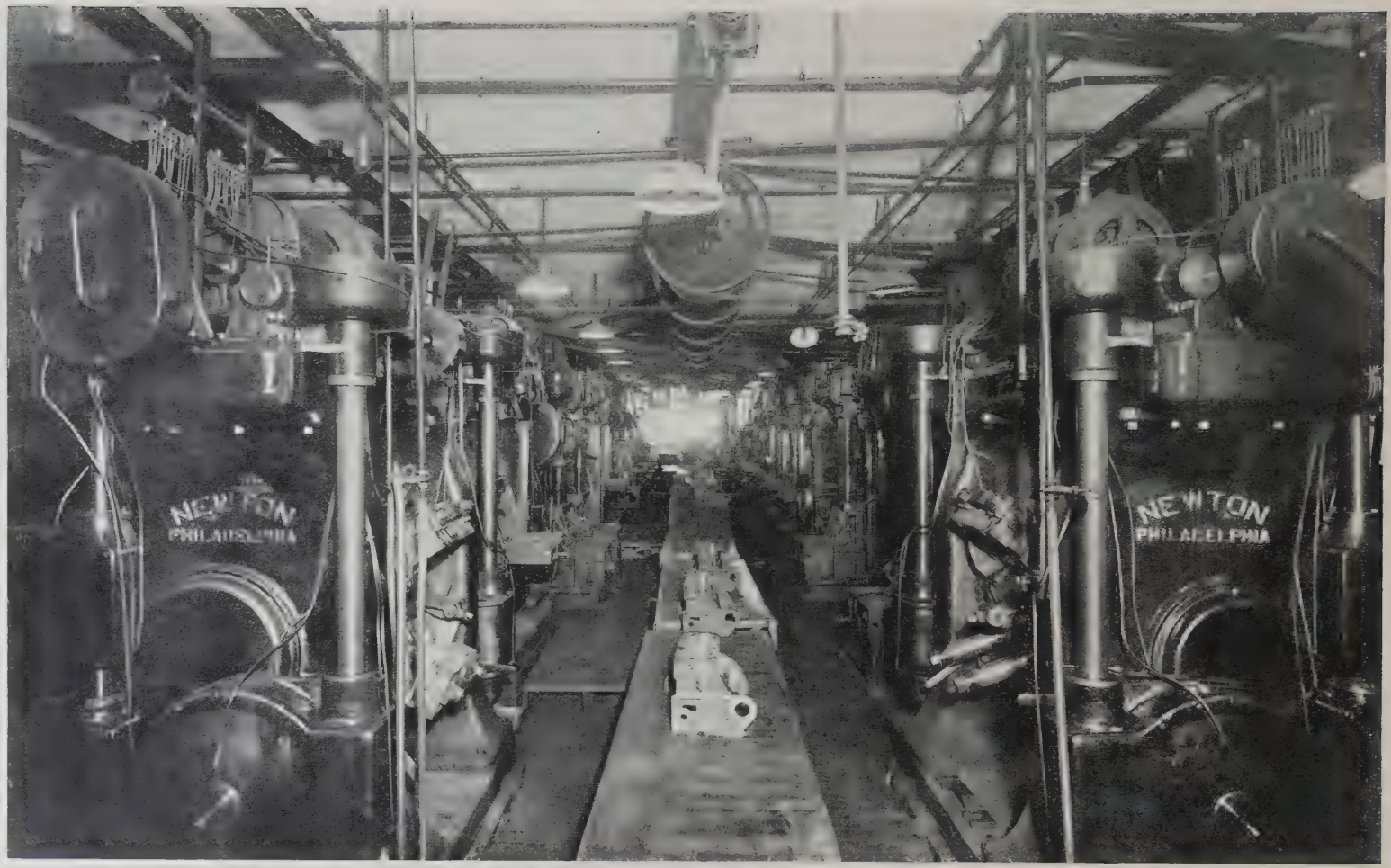
And this, in turn, throws some light on the question of who sets motordom's fashions. A manufacturer making an assembled car on a small scale brings out something new in body design—say, a new sport model. It has various little touches that please the eye and promote the comfort of the passenger.

When it goes before the public, many buyers forget the fact that the value of a motor car is mainly in the chassis, and make a selection without considering that phase of the subject.



THE CYANIDE OF POTASSIUM FURNACES IN A DETROIT MOTOR-CAR PLANT

Heat-treating and case-hardening have done a vast deal toward making the automobile stand the strains to which every-day usage puts it. This one plant uses enough cyanide every day to destroy the entire population of the New World (see text, page 400).



ONE OF THE REASONS WHY PEOPLE OF MODERATE MEANS CAN AFFORD GOOD CARS

In the elimination of lost motion, automobile manufacturers are ever on the watch for improvements. In the machining of engine blocks older installations take one block at a time, put it on a bed and move the cutting tool back and forth over it, with each backward movement an idle one. The machine here takes a half dozen blocks and rotates them past the cutting tool, eliminating the idling back motion. Reduced cost of milling engine blocks is the result.

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HANGING ON BEHIND: THROUGH A FORD IN ROCK CREEK PARK, WASHINGTON, D. C.

A Michigan lumberman invented the modern spark plug; a Russian Jew, the demountable rim; a mid-western engineer, the orthodox self-starter; and a New England Yankee, the antiskid chain—a quartet of inventions that has been a major factor in the development of motoring in America.

© Ewing Galloway

HEAVY GOING IN THE WAKE OF A RAINSTORM IN THE CEDAR BREAKS REGION OF SOUTHERN UTAH

It is estimated by the National Motorists' Association that two and a half million car-owners annually take to the roads of the country for a vacation, and this number represents about ten million tourists.

Photograph by International Newsreel

THEIR OWNERS ARE WATCHING THE YALE-IOWA FOOTBALL GAME: THIS PICTURE WAS TAKEN NEAR THE YALE BOWL

Then the staid manufacturer of a staple chassis that has stood the test of years finds that, if the new types are not to undermine his sales, he must meet the competition, and so he sets about to do so, with the result that a new fashion becomes a settled part of the industry.

WHEN MILADY SETS THE PACE FOR EASE AND SAFETY

Statistics have been gathered which show that the ladies have an unsuspected voice in the selection of the family motor car. This is causing most manufacturers to cater to their tastes with great care.

One company puts a thermos bottle in as standard equipment. Another makes his oil-draining system so easy of operation that a woman can drain the crank case without difficulty. Another groups the instrument-board equipment under one glass, so that the board can be kept looking like new.

Still another puts on an improved type of brake-equalizer, so as to insure, in a measure at least, Milady driver against skidding. Gear shifting and clutch operation have been made easier to catch her eye. Accelerator pedals have been redesigned, so that they function equally well with high-heeled dress boots and low-heeled sport shoes. Spark and gas control levers on the steering wheel are being redesigned to obviate the danger of feminine fingers being caught between the control sectors and the steering-wheel spokes when turning corners, and to lessen the risk of stray ends of the woman driver's finery being torn in the control mechanism as she drives to the next bridge party.

One manufacturer provides for automatic recranking in case she stalls her engine, and another takes steps to insure a better mixture in a cold engine or in a sudden acceleration of the motor.

TAKING YOUR BED WITH YOU

In an attempt to capitalize America's love for camping out, one car builder has announced a model in which the Pullman berth idea is copied. Press a button and the back of the front seat drops down. Reverse the cushion on the rear seat, and lo! you have a bed inside your car! Tents eliminated, you are ready to make your bed wherever night overtakes you—by a babbling brook, under a fine willow, or wherever fancy dictates.

The maker of a standard, medium-priced car was asked what he thought would be the future trend of car design for the masses. He replied that his factory was working toward the time when it would put out a model weighing about 1,800 pounds and accommodating four instead of five passengers.

In no other field does one find such close coöperation as in the motor-car industry. The manufacturers in the early days were forced to unite for the purpose of fighting hostile legislation and for making the American public motor-minded. They found that they could make a better market for their individual cars by teamwork with their competitors in selling the car idea. They learned that their success was linked with their competitors' success.

"COÖPERATIVE COMPETITION"

So "coöperative competition" became their watchword. Young, virile men with imagination made this policy a tremendous success, so much so that they agreed among themselves to form a pool of ideas. In this pool there are about 500 patents, and every member of the National Automobile Chamber of Commerce, which includes practically all the leading manufacturers, voluntarily agrees to let every other member use any or all of the features of construction and equipment owned by them individually without the payment of royalties or other compensation. They hold that the better service all cars render the greater will be the demand for their own.

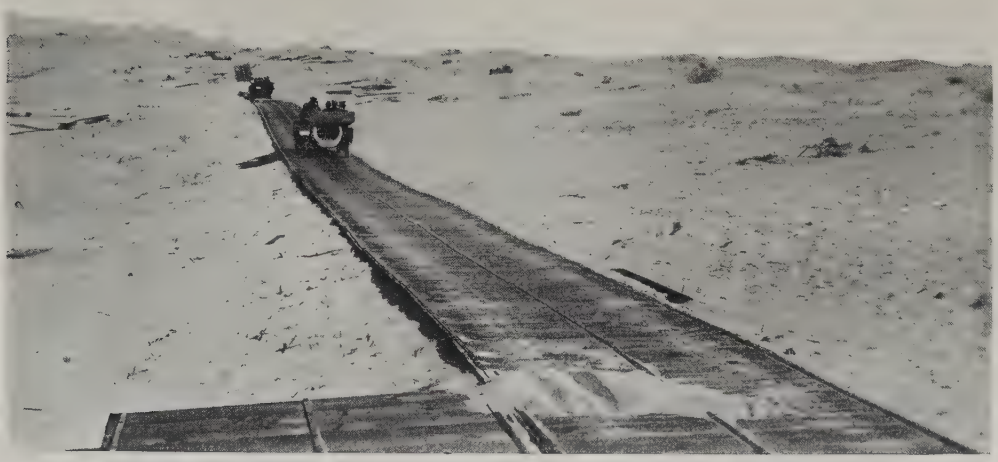
One of the interesting organizations within the industry is the Society of Automotive Engineers. Its main purpose, when organized, was to promote standardization among manufacturers, but it has found its principal continuing mission to be that of a research body serving as a clearing house in automotive engineering and design development.

Standardization has been a big task. The fixing of metal standards has assured a consistent and dependable product to the discomfiture of foreign manufacturers. Sizes in wheels and cotterpins, threading of spark plugs, details of tire

Photograph by Charles M. Miller

AT THE FOOT OF YOSEMITE FALLS: YOSEMITE NATIONAL PARK

It is only a little more than twenty-five years ago that the first sale of an automobile was made in this country. The National Motorists Association estimates that more than 2,500,000 car owners will this year use the automobile highways in visiting America's many points of interest.



A COMPLETED STRETCH OF PLANK ROAD OVER THE CALIFORNIA DESERT

Note the turnout in the left foreground. These are built at frequent intervals. Such a road would not be practical where there was excessive shifting of sand dunes.

fastenings, angles of valve-seating, and scores of other items that could be made to fit all cars without detracting in the slightest degree from the engineering originality in car construction that differentiates one car from another, have been standardized, and this standardization lies at the base of quantity production, which, in its turn, plays a fundamental part in American supremacy in the automobile field.

It was found that one company making lock washers for the automobile manufacturers was obliged to make 800 different kinds of washers for bolts ranging from three-sixteenths to one-fourth of an inch in diameter.

It was likewise discovered that the automobile manufacturers were using 1,600 different sizes of steel tubing. Standardization has reduced the number of sizes of washers and tubing to a minimum, with saving in cost of manufacture, reduction of inventory, and convenience to the public.

HOW AUTOMOBILE RACING GIVES THE PUBLIC BETTER CARS

In the early days automobile racing was indulged in for the purpose of showing that cars could get over the road at all, and such races as that sponsored by newspapers in 1895 seem ludicrous at this distance.

Later, people began to think of speed. They wanted cars that could make thirty miles an hour, and the car that showed the most speed was the one that found the readiest sale.

In one of these races for advertising purposes, Henry Ford himself took part in a contraption he called the "Arrow." He undertook to run it a mile straightaway over the ice. The ice looked smooth, but when he got up speed he found it was covered with fissures. To call off the race would be throwing his advertising into reverse gear. So, in his words, "I let the old 'Arrow' out. At every fissure the car leaped into the air. I never knew how it was coming down. When I wasn't in the air, I was skidding, but somehow I stayed top side up and on the course."

Some years later road racing came into vogue, and it did a vast deal in the development of motors, the evolution of spring design, the perfection of ignition, and the solution of lubrication problems.

After the road races came the reliability runs, made under conditions that found the weak spots in the stock cars

Photograph by Pacific and Atlantic Service

THE OREGON STATE MOTOR ASSOCIATION PLANS TO TAKE OREGON SCENERY ABROAD

The back of the Association's pathfinder car is being painted with a scene showing Mt. Hood, with the city of Portland in the foreground.

put under test, and they, in turn, served to shake down engineering standards to the level of dependability.

But later came the speedway races. To them came the best ideas the ablest engineers in the world could evolve, to be put to the grueling tests that only a speedway race can set up. The first speedway built was at Indianapolis, with James A. Allison, A. C. Newby, and Carl G. Fisher as the moving spirits in its construction.

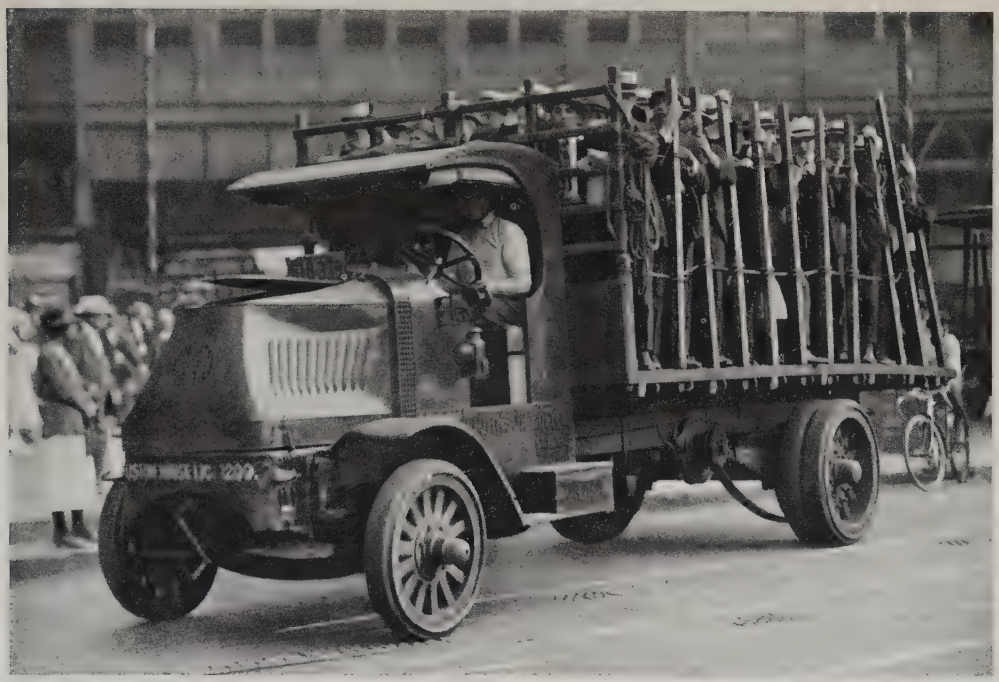
The roadbed was built of earth, like a country highway, but after the first test of 500 miles the conditions were found to be dangerous and unsatisfactory, and straightway it was rebuilt of brick and made to simulate street conditions. No car ever entered one of the races thereafter and went through the grueling test without revealing its weak points.

Every automotive engineer in the profession seeks to know as fully what to avoid as what to incorporate in his future models. The result has been that these terrific tests at Indianapolis have always brought the engineering talent of the country together.

Under the lessons learned there—and obtainable in no other manner, since bench tests cannot develop road conditions—cylinder displacement has been reduced, fuel economy has been evolved, and safety has been forged into every element of your motor car and mine on the mighty anvil of a speedway and under the powerful hammer of high speed. Harmony, balance, dependability, tire mileage, and sturdiness have come from the flaming forge of a hundred miles an hour (see illustrations, pp. 344 and 345).

THE ROMANCE OF QUANTITY PRODUCTION

Quantity production is, after all, the foundation stone upon which rests the



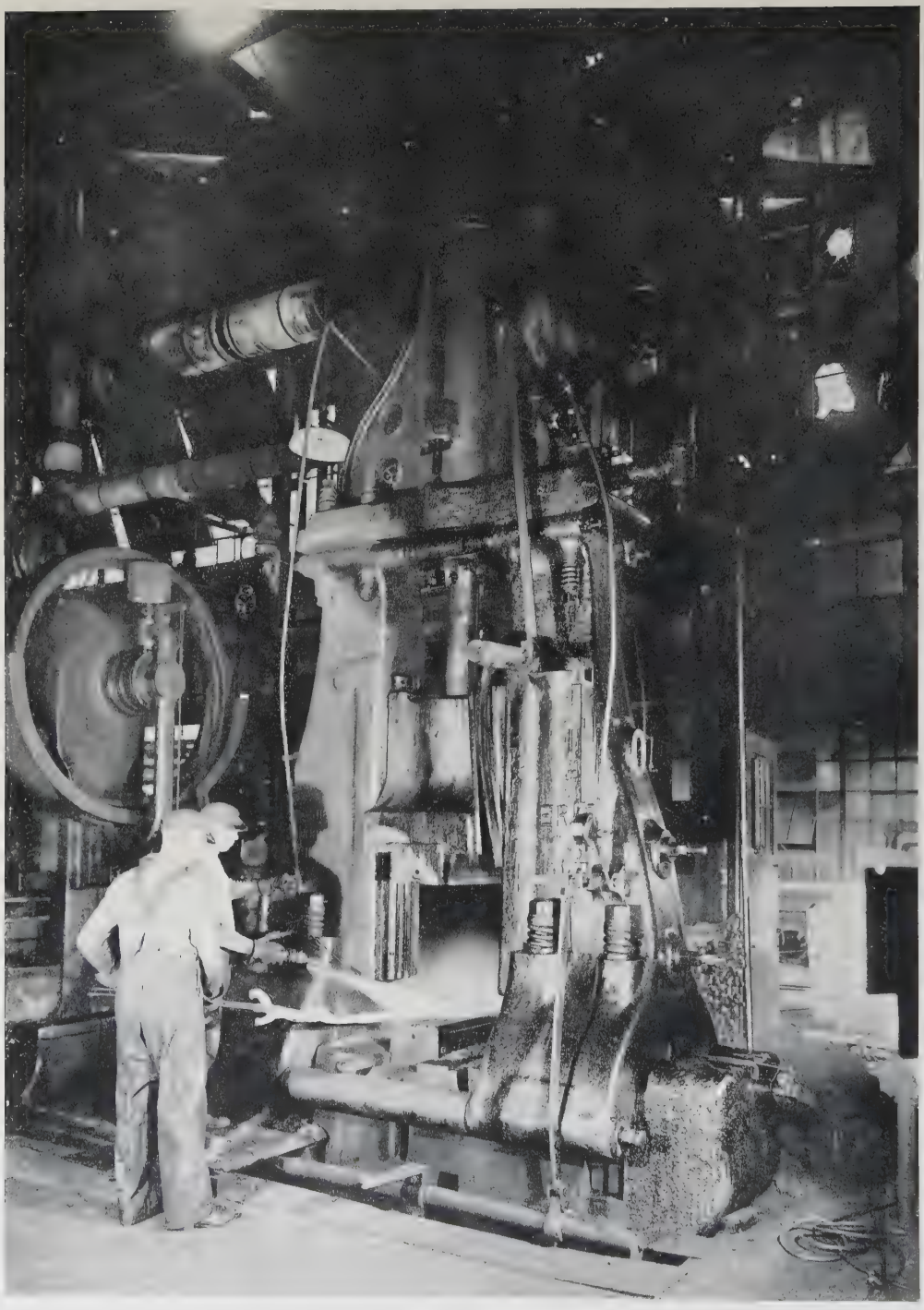
MOTOR TRUCKS PROTECT THE PUBLIC DURING STREET-CAR STRIKES

In many cities motor cars have helped the public get down town when the street-car service has been interrupted.

Photographs by Paul Thompson

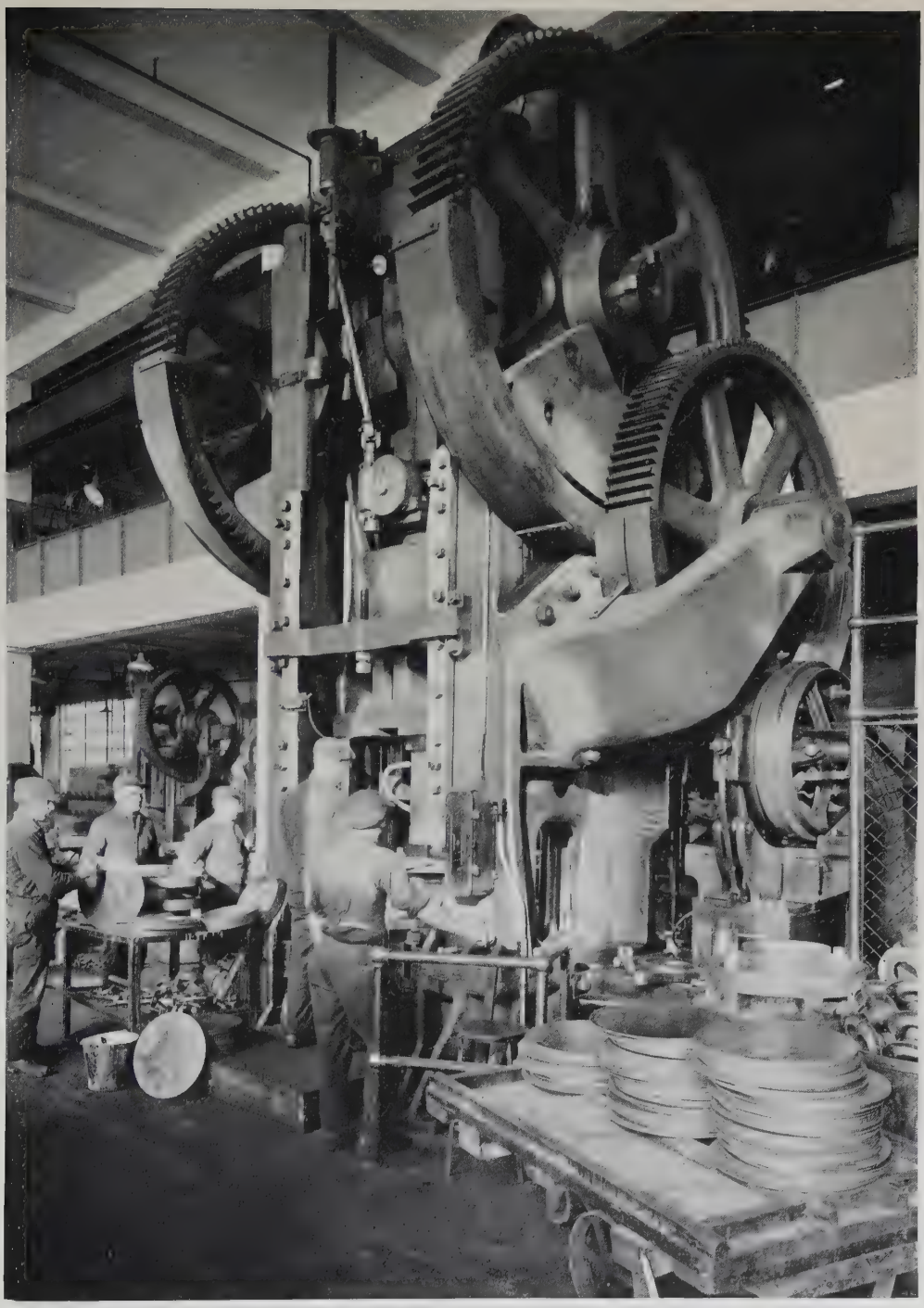
HAULING PULP WOOD IN THE MAINE WOODS

By combining truck, tractor, and bob-sled, the Maine lumbermen have found a practical way to move pulp wood, used in the manufacture of paper, over the ice and snow in winter.



DROP-FORGING A FRONT AXLE

After the heat treatment the axle ingot comes to this big, four-ton hammer and is forged into shape. This machine can be so delicately operated that it can be made to tap a watch without breaking the crystal (see text, page 400).



THE TYPE OF PRESS THAT MAKES BRAKE DRUMS

The flat disks from which the brake drums are made are cut out of sheet steel like cookies out of dough. They are then fed through the machine here shown and are pressed into drums, as shown at the left.

STUDENTS LEAVING THE PINE LEVEL, ALABAMA, JUNIOR HIGH SCHOOL

success of the automotive industry. Without it motor cars would certainly be beyond the means of millions of persons who now own them. In the early days they were largely made by hand. Today the use of a paint brush or a pair of spanners, the movement of a lever, or the holding of an electric wrench represents about the limit of handwork in motor-car manufacture. That precision tools are superior to human senses in automobile making has been strikingly demonstrated.

CLIPPING MINUTES IN MOTOR MAKING

In the early days the material for the assembly of a car was simply dumped together in a space on the floor where the automobile was to be set up. Then the Ford Motor Company thought to try out the overhead trolley system used by the Chicago packers and a division of labor.

One man could assemble a flywheel magneto in twenty minutes. When the moving line was installed and divided into twenty-nine operations, the time was cut down to less than fourteen minutes. By raising the height of the line eight inches, so as to save stooping, the time was reduced to seven minutes. Other experiments reduced the time to five minutes.

In 1913, 9 hours and 54 minutes were required to assemble a motor in the Ford plant. Six months later the time had been reduced to 5 hours and 56 minutes.

By early methods 12 hours and 28 minutes was the time required to assemble a chassis. Then the idea was evolved of towing the chassis down a 250-foot line with a rope attached to a windlass. Six assemblers walked down the line, picking up parts from various piles and attaching them as the car moved. This speeded up the assembly to 5 hours and 50 minutes. By placing the work waist-high and bringing the speed of the conveyor to the most effective point, the time of assembly was reduced to 1 hour and 33 minutes.

It was quite a task to determine at what speed each conveyor should move so as to give each workman ample time to do his bit properly and yet economize every second. The flywheel magneto assembly line was tried at sixty feet a minute, and that proved too fast. Eighteen feet per minute proved too slow. Forty-four feet finally proved to be the correct velocity.

© Underwood & Underwood

NOW COMES THE TRAVELING GROCERY

A Cincinnati grocer decided to try a "help yourself and pay as you leave" store on wheels. He found the venture so profitable that he proposes to add other cars to his fleet.

© Underwood & Underwood

A PREACHER AND HIS PERIPATETIC PULPIT

A Brooklyn clergyman decided to fulfill literally the admonition to "go out into the highways." His traveling chapel has stained-glass windows, a small organ, and a steeple that can be lowered to permit passage into a garage.

In a leading plant the chassis assembly line moves at six feet per minute and has forty-five operations. The first man puts on the mudguard brackets, the motor arrives in the tenth stage, and so on. Some men do only one or two small operations. The man who places a part does not fasten it; the man who puts in a bolt does not put on the nut; the man who puts on the nut does not tighten it.

On operation No. 34 the motor gets its gas, having received its oil earlier. At station No. 44 the radiator is filled with water, and at No. 45 a button is pressed, a pair of rollers in the floor under the rear wheels begins to revolve rapidly, the wheels spin, the engine turns over, and the car glides away under its own power with a driver at the wheel.

Going back a little, the molding in the foundry is all done by machinery. A line is adapted to the making of a single type of casting. In the casting of the engine block there are three lines with a capacity of 5,000 blocks every eight hours, or 15,000 when working three shifts a day. The making of the molds and cores and the packing of the cores are all done while the line moves. At another point the molten metal is poured, and by the time the mold reaches the end of its journey, the casting is cool enough to start on its automatic way to cleaning, machining, and assembly.

UNPRODUCTIVE STEPS ELIMINATED

The piston and connecting-rod assembly is another illustration of the elimination of lost motion in the industry. Under the old plan a man assembled twenty pistons and rods an hour, and subdivision of work didn't seem to promise much saving.

The workman pushed the pin out of

Photograph from E. E. Pierson

A MOTORIZED TYPEWRITER SALES SERVICE

A Bloomington, Illinois, typewriter agency decided to send its salesmen on the road with a full line of samples. A specially designed automobile body was installed, and now the typewriter store travels from town to town and from office to office. Each machine is mounted on a board that can be pulled out and made to serve as a demonstration desk.

the piston, oiled it, slipped the rod in place, replaced the pin, tightened one screw and opened another.

Then came a foreman with a stop-watch. He found that four hours out of every nine were spent taking steps. He subdivided the work into three operations, eliminated unproductive stepping, and now there are 46 pistons assembled per man-hour.

Painting the rear axle was an operation that took two men several minutes; new machinery was devised, and now it is a thirteen-second job for one man.

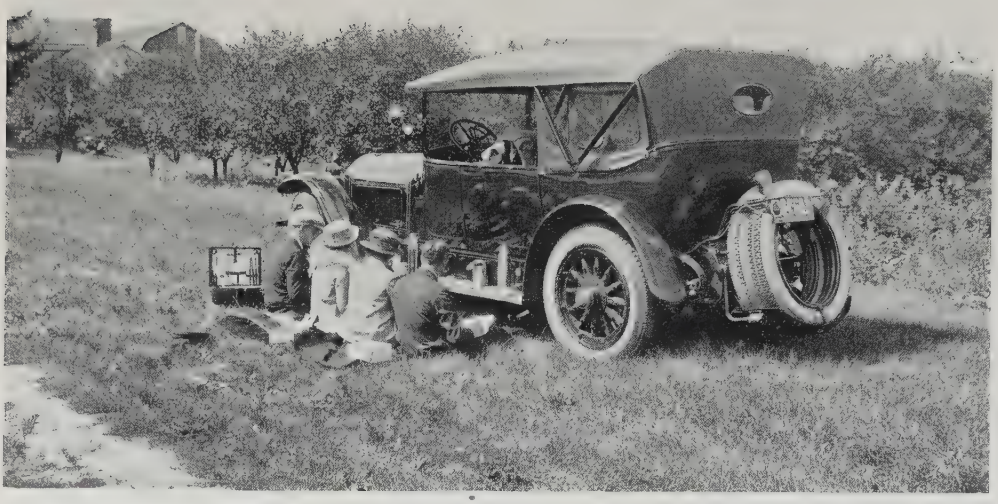
With its ninety-five tubes, a radiator, even on a Ford, is a rather complex affair. Fitting and soldering these tubes by hand was a long operation, requiring many skilled men. Now a machine is in use which can make 1,200 radiator cores in eight hours, the soldering being done by moving the radiator through a furnace on a metal conveyor, which entirely eliminates the tinsmith.

SUGGESTIONS FROM THE RANKS

Suggestions come from everywhere in the average quantity production automobile factory, and especially from the ranks. In one plant a Polish workman who could speak no English found that if the tool in his machine were set at a different angle it would wear longer. That discovery saved thousands of dollars in tool-grinding. Another, running a drill press, rigged up a little fixture to save handling after drilling. Tens of thousands of dollars are saved annually by it.

A proposal that castings be taken from the foundry to the machine shop on an overhead conveyor saved seventy men in the transport division.

Seventeen men were required, when production was much smaller than now,



A WEEK-END ALONGSIDE ONE OF NEW YORK'S STATE HIGHWAYS

Photographs by George R. King

BUYING PEACHES ON A NEW YORK STATE HIGHWAY

Motorists in New York and New England find everything, from apples and peaches to eggs and jellies, offered for sale by the roadside; and the prices are usually surprisingly low.

to remove burrs from gears. A mechanic roughly designed a machine to do the work. It was perfected, and now four men have several times the output of seventeen, and none of them works as hard as any of their predecessors.

Another man suggested a welded rod instead of a solid one in the chassis, and the resultant economy meant more than half a million dollars a year in this plant. An improvement in heat-treating camshafts reduced the need of shaft straighteners from 37 to 8, although production has nearly doubled.

THE STORY OF THE GEAR-WHEEL DIPPER

Does the reduction of the intricacy of the work a man performs deaden his initiative or reduce the value of his work to the industry? Many people have asked that question.

In one factory I visited, perhaps the most monotonous task is that of a man who picks up a gear with a steel hook, shakes it in a vat of oil, and then places it in a basket. The monotony of the motion required never varies, and is done without either muscular energy or mental activity. He has done that same job for eight years and has refused offers of promotion. But he has saved $40,000, owns his own home, and drives his own car. It is said that a thorough study has not revealed in that factory a single case of a man's mind being twisted or deadened by such repetitive work.

As to taking skill out of the industry, it is pointed out that, rather, it makes the unskilled laborer partner of the skilled engineer, enabling him, with a mechanism designed by the engineer, to do a job commanding twice the pay he could get without the machine.

Photograph by Clifton Adams

BOOKS COME BY MOTOR TO GLADDEN THE LIVES OF THE COUNTRY CHILDREN

Many counties are introducing a motorized circulating library service for the rural districts.

LITTLE ECONOMIES THAT MAKE BIG PROFITS

The old-time tool-sharpener was an expert judge of heat temperatures, but his was a hit-or-miss operation. Now the man who heat-treats steel in an automobile factory has nothing to do with the heat. He never sees the pyrometer that tells when the necessary degree of

Photograph by Clifton Adams

EVEN THE MOUNTAIN COTTAGE FEELS THE TOUCH OF THE AUTOMOBILE

Washington County, Maryland, sends its free library service up into the foothills of the mountains to carry the benediction of books to the poor.

THE MORNING TOILET ON TOUR

Camping outfits of many kinds and degrees of comfort are on the market to-day, and the demand for them is showing a remarkable increase with each succeeding tourist season.

MINIATURE "TWIN-LEG" SEDAN

A Boston mechanic built his son a toy automobile with everything orthodox save an engine. The young motorist insisted on finding a "cop" who would "arrest" him.

Photographs by International Newsreel

SEEING THE COUNTRY GYPSY FASHION

This bungalow car, fitted with the comforts of a modern apartment, including electric lights and plumbing and a convertible living and bed room, has brought happiness to a motor-minded family. Even the driver's seat can be converted into an upper and lower berth.

A GROUP OF CHILDREN FROM SIX STATES FORMING A HAPPY CIRCLE IN OVERLAND PARK CAMP GROUNDS, DENVER, COLORADO

Hundreds of cities and towns have provided camps for tourists, most of them equipped with electric lights, kitchens and sanitary conveniences, and provided with police protection. One Missouri town of 7,000 inhabitants recently made a count. Its citizens welcomed 23,520 cars, carrying 100,000 passengers, during the touring season. More than 3,000 cars, carrying 12,000 passengers, stopped at the town's free camping site.

temperature is reached. Colored electric lights are automatically switched on to tell him when to remove the steel.

Even the "flivver" type of car has about 5,000 parts, counting screws, nuts, and all, and assembly on a quantity production basis must be nicely worked out in every plant. A shortage in a single type lock washer or bolt would tie up the whole line; so the flow of parts must always be constant and dependable.

When it is remembered that the saving of a single cent on each car's production cost means nearly $20,000 a year in the case of the Ford, and $5,000 in the case of the Chevrolet, it can be seen what large prizes small economies win in big factories.

In one plant, the sweepings alone represent a saving of more than half a million dollars annually, and the elimination of a single style of bolt means another half million. Making transmissions in the factory, instead of buying them, saves nearly $20,000,000 a year.

To see a big blast furnace tapped, to watch its white-hot stream of molten iron flow off into giant 75-ton ladles, from

Wide World Photograph

THE REMAINS OF A RAIDED STILL ABOARD A FAITHFUL "FLIVVER"

There is a Ford driver born every thirteen seconds to keep pace with the output of the automobile plants at River Rouge and Highland Park.

© Ewing Galloway

A MODERN MOTOR BUS AND A CAR OF THE TRACTION LINE IT SERVES

Sixty electric lines are now using motor busses to supplement their service. They serve admirably in new territory as feeders to established street-car and interurban traction lines.

Photograph from the U. S. Signal Corps

MOTORIZED TRANSPORT IN THE UNITED STATES ARMY

which it is then emptied into cupolas, to be, in turn, drawn off in small quantities and poured into waiting molds, is to behold an epic of industry—molten iron from the blast furnace's fierce flames poured into the mold itself, without the intervening pig-iron stage.

Going through the major plants of the industry is an experience one can never forget. Following the main processes in car fabrication, we pass from the foundry, where the fiery liquid is molded into parts, into the forge building, where they are heat-treated and shaped.

Here is a giant triphammer capable of delivering a four-ton blow, and yet so skillfully operated that it can be made to tap a watch without breaking the crystal, or to touch a finger ring so lightly as to leave only a slight grease mark thereon (see page 386); there, a tremendously powerful press that shapes a crankshaft with the seeming ease with which a child presses out a mud pie.

Elsewhere we see a battery of pots, using, in heat-treating various parts that are to be subjected to hard wear and rough usage, enough molten cyanide every day to kill all the people in the Western Hemisphere (see page 376).

Leaving the forge department and passing on to the machine shop, one encounters a thousand mechanical marvels. There one sees immense multiple drill presses, some of them capable of boring more than fifty holes simultaneously in four directions, each perfectly true in its direction, in an engine block; piston-grinding machines that automatically grind four pistons at a single operation, facing the top and turning the outside diameter at the same time; screw machines that automatically feed themselves long steel rods, four or more at a time, and transform them into perfect screws—heads, threads, and slots.

A whole battery of machines in this department is busy milling the "cheeks" on the "throws" of crankshafts, each one doing what formerly required twelve different operations, on as many machines, each manned by an operator.

Photograph by Paul Thompson

A MEMBER OF THE MOTOR CORPS IN THE WORLD WAR

Another battery of machines is cutting teeth on gear-wheel blanks. One man attends a number of them, and all they ask is that he give them a regular supply of blanks and liberal streams of oil over the cutting surface.

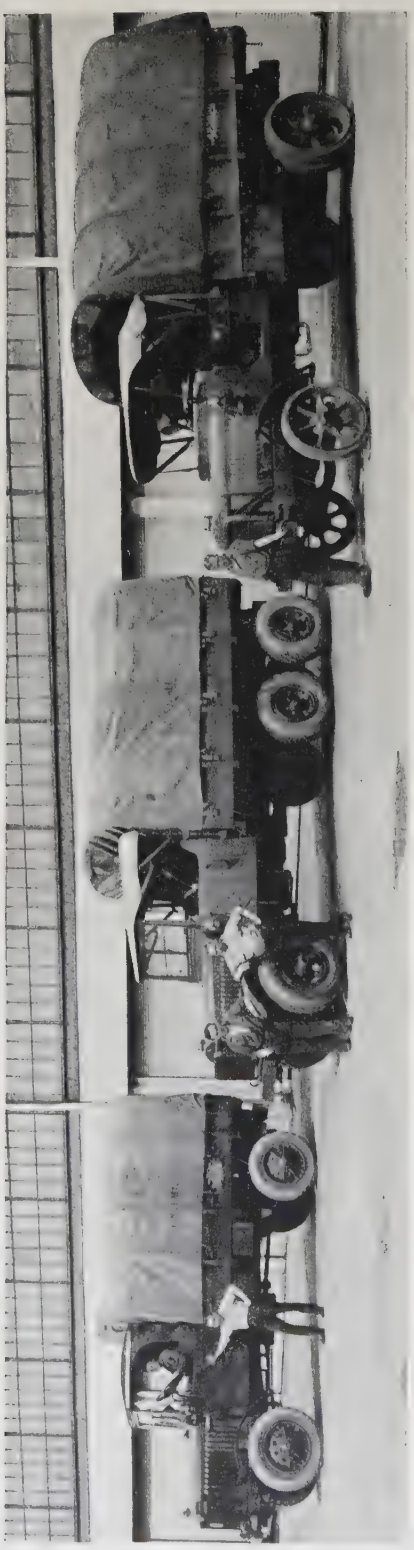
FASHIONING FENDERS AND BRAKE DRUMS

Elsewhere an endless procession of engine blocks is coming down the line, each block being cut and trimmed into shape by powerful cutters to which iron seems little harder than cheese. One type of these milling machines takes a series of blocks and rotates them past the cutting tool instead of moving them one at a time back and forth on a platform. One of these machines takes the place of twelve of earlier design, occupies only a fifth as much floor space, and reduces the human factor to a minimum.

From the machine shop one passes to the stamp-press shop, where other wonders await him—machines that cut blanks out of sheet steel as easily as the housewife cuts cookies out of dough, and much faster; others that transform steel disks into brake drums at one operation; still others that stamp fenders out of sheet steel with a single movement.

Here are spot-welders that baste the two parts of an axle housing together just as a seamstress bastes a sleeve before sewing it. The operator holds the two pieces of steel together, touches a switch, melts a spot on the two edges, and causes the steel to run together. This binds the two parts together for the man who is to finish the job.

One watches cylinder-grinding, where 1/10,000 of an inch is the limit of tolerance in departure from exact size; follows piston-ring inspection with measuring instruments, in which rays of light are made to reveal fine variances that escape detection by ordinary means; studies dynamometer tests that reveal the exact horsepower developed at all speeds; examines the machine that calculates the area of an irregular piece of leather a thousand times as fast as it could be determined by arithmetic! (see page 362).



Photograph by Clifton Adams

ARMY TRUCKS AT CAMP HOLABIRD, BALTIMORE, MARYLAND

The truck on the right is the regulation army truck widely used by our Expeditionary Forces in France. In the middle is the new six-wheel truck recently devised (see page 404). By the use of oversized tires, the ratio of weight per square inch on the road surface is reduced from 7 to 2½. The truck at the left is also a new design, built at Camp Holabird and having a four-wheel drive. This truck will go almost anywhere that a caterpillar tractor can operate, and some places it cannot, and at the same time it has a high road efficiency.

Likewise, one is inclined to linger along the assembly lines, watching engines and transmissions and rear axles being built up and coming down to the main line where they meet the chassis and are made a part of it. The paint shop, where the enamel is sprayed on and the steel body is sent on moving platforms through the drying kilns; the upholstery and trimming department—a score of fascinating activities beseech attention, but their "say" must be with pictures (see pages 353-355, 358-360, 362, 363, 366-370, 376, 377, 386, and 387).

The employment of machinery in the making of automobiles and the quantity of product turned out are among the marvels of this mechanical age. If old-time hand methods were used, it is estimated that a single plant in the industry would require two million workmen where now less than 100,000 are employed, and even a "flivver" would cost almost as much as the most expensive car to-day.

A TRIBUTE TO GENIUS

The American tribute to the automotive engineer's genius has made his industry the third largest in the United States and has enabled it to bow petroleum into second place. The automotive vehicle manufacturer has become the largest producer of finished goods in the world.

Looking down the line of motor cars put out, from the Packards, Pierce Arrows, Lafayettes, Locomobiles, Lincolns, Cadillacs, and Marmons, with their superlative standards of construction; to the Fords, Stars, Grays, and Chevrolets, designed to meet the essential requirements of those of moderate means, we find that everywhere there is an amazing amount of mileage in them per dollar invested, when given proper care and operated at speeds consistent with their construction.

H. C. S.'s, Stutzes, Wintons,

Hudsons, Studebakers, Chandlers, Nashes, Franklins, Buicks, Reos, Hupmobiles, Maxwells, Chalmers, Dodges, Durants, Overlands, and many others, offer a range of choice in price and type to meet every taste and every requirement, but any one of them represents a good car within the price range to which it belongs.

It is true that the manufacturers, in the main, make big total profits, but these grow small when brought down to a per-car basis. Most of these profits arise, moreover, by economies. The Studebaker South Bend plant, for instance, spends $3,000,000 for a new foundry; this will pay for itself in the economies of a comparatively short time.

THE HIGH COST OF DISTRIBUTION

The high cost of distribution is one of the striking factors of the automotive industry. The economist who wrote that it costs as much to sell a car as to make it probably went a little beyond the mark, but at that, the margin between the wholesale and retail prices is vastly larger than that between cost of production and the wholesale price.

Economists generally agree that more than one-half the price the consumer pays for the commodities he uses represents the costs and profits of handling them between the producer and the consumer. The late President Harding called this one of the greatest problems of civilization, if indeed not the greatest.

The motor truck has been asked to help solve this problem, and it seems to be making a substantial contribution thereto. A big New York firm found that the ton-mile delivery cost fell from 48 cents with horses to 20 cents with motor trucks.

In Milwaukee, Wisconsin, the milk companies decided to motorize their quantity milk delivery, and the result was a saving of two cents a quart on their product.

A Detroit department store has instituted a new motorized delivery service and now delivers within a radius of 75 miles, giving a vast rural and small-town population a service never before thought possible.

A study of truck statistics shows that eighty-three out of every hundred built last year were of one-ton or less capacity. A quarter of a million trucks were built that year and there are now about a million in commission in the United States.

In most cases where the motor truck has gone into delivery service in competition with the horse, it has been able to cut down the delivery cost in almost as large a proportion as it accelerates the time of delivery. We all love the horse, but economy is the prime consideration of the business world.

The truck also has a vast field before it in handling the short-haul freight that the railroads now handle. Any rail shipment that is for less than forty miles is apt to be carried at a loss. The railroads, it is said, want to give this business to the motor truck. Likewise, they would gladly remove their freight depots from the centers of cities, since the interest on such investments wipes out the profits of package freight handling. They would like to have their freight stations outside of congested districts and let the motor trucks take care of the city delivery.

CINCINNATI RESULTS SHOW WHAT TRUCKS CAN DO

In Cincinnati motorized freight terminals have been established. In a single year they released 66,000 cars for main-line movement on the railroads, eliminated 300,000 switching cuts, advanced freight movement over 52 hours, and cut the labor cost in half through the elimination of rehandling.

One of the abuses of the motor truck is to put it on long hauls that parallel railway lines. Statistics definitely show that long-haul truck lines sooner or later go out of business, only to be succeeded by others which, in their turn, find the competition ruinous. But in the meantime, they have made uneconomic inroads into the earnings of the railroads and cut down the service rail lines can render to a fraction of its former efficiency.

One of the uneconomic situations which has developed in the past generation is strikingly illustrated between Dayton, Ohio, and Indianapolis, Indiana.

There used to be a good rail service between these two cities that yielded a reasonable profit to the railroads. Then there came into the field a new carrier—

Photograph by Clifton Adams

A NEW SIX-WHEEL TRUCK DESIGNED BY THE QUARTERMASTER'S DEPARTMENT, U. S. A., AT CAMP HOLABIRD

This picture shows the flexibility of the truck construction of the new six-wheel type the army is developing. The one-foot rule shows the height of the block on which the one wheel rests. The block on the opposite side is six inches high. The four-wheel rear construction shown here can be built for the Government at practically the same expense as the orthodox two-wheel single-axle construction.

an interurban traction line. It so ate into the business of the railroads that they were forced to curtail their service.

But still later the fine motor highway between Dayton and Indianapolis was opened up, and it, in turn, made heavy inroads upon the traction line.

Some day there will be a coördination of our transportation facilities that will adjust such conditions, making each an asset rather than a liability to the other. When railroad, traction and motor lines are correlated properly, each will add to the strength of the others and the public will be vastly the gainer.

The truck is fast eliminating the horse from the cities of the country. Between 1910 and 1920 the number of horses in New York decreased from 128,000 to 56,000; in Chicago, from 68,000 to 30,000; in Philadelphia, from 50,000 to 19,000; in Baltimore from 15,000 to 7,000; in Cleveland, from 16,000 to 4,000.

The Quartermaster's Department of the Army, at Camp Holabird, under the direction of Arthur W. Herrington, is developing two types of trucks that promise to revolutionize truck construction for heavy duty. One of these types has a four-wheel drive, with oversize pneumatic-tire equipment. This truck will go almost anywhere that caterpillar tractors can go, and some places that they cannot, in cross-country work and on wet clay roads; and on top of that, it will do anything that a regulation truck will do on good roads. As efficient as a caterpillar in bad going and as speedy as a regular truck on a good road surface, it can be built at a reasonable cost.

The other is a six-wheel truck capable of handling a 7½-ton load, with even less pressure per square inch of tire-road contact than the ordinary 3-ton solid-tire truck. The four rear wheels are assembled after the fashion of the ordinary railway-car truck, and are driven by a double differential from the propeller shaft.

Photograph by Paul Thompson.

A FLEET OF TRUCKS ON THE COURTHOUSE PLAZA IN BALTIMORE EN ROUTE FROM DETROIT TO FRANCE

Both of these trucks are built up out of standard parts, and not only will they develop new fields for automotive transportation in time of peace, but they will also constitute the types of heavy-duty vehicles the Army will want in the unhappy event America ever has to unsheathe its sword again.

THE TRACTOR'S PART IN THE HORSELESS AGE

The farm naturally is the last stronghold of the horse. The natural inertia of the farmer has something to do with this. But more than that, the tractor that will serve him as well in its field as the motor car does in its sphere has not until now shown signs of appearing.

First of all, it must be a tractor that can utilize existing farm implements. An investment of $3,500,000,000 in horse-drawn equipment is too great to send to the scrap heap.

It must, therefore, be capable of operation by reins, just as if it were a team of horses. This gives freedom to the operator to attend the machinery being pulled, as well as to the tractor itself.

In the second place, it must be so designed that it can be used in cultivating row crops like corn; it must be able to straddle one or two rows and turn in a small radius at the end.

In the third place, it must be able to render efficient belt-power service, so that the farmer can hitch it to a wood saw, a threshing machine, and whatnot.

The fourth requirement is that it shall take the place of the horses on the road as well as in the field, so that it may be fully able to substitute the horse.

Happily, all these specifications have been, or are being, filled except the last. To make a wheel that is readily converted from one with a cleat-studded rim for field duty into one with a smooth rim for road work is a task that is engaging the attention of the best engineers. One manufacturer says he will pay $25,000 for the wheel that completely meets this need.

A NEW ECONOMIC TRANSFORMATION

With Canada announcing a half-billion-bushels wheat crop, with Siberia on the eve of bonanza cereal farming, with

© Paul Thompson

FIGHTING A CHEMICAL WAREHOUSE FIRE IN NEW YORK WITH MOTORIZED APPARATUS

The fine spectacle of dashing fire horses is rapidly disappearing. Many of the major cities have completely motorized their fire-fighting equipment. Not long ago the last of Chicago's horse-drawn fire apparatus was discarded, the occasion being made a ceremonial one. A box a short distance from the station was pulled to start the four horses on their last run; after they had left, the new motor equipment was driven in. The efficiency of fire apparatus involves speed and convenience in reaching a fire. Breakage due to rapid runs and the additional hazards of bad pavements and crowded streets result in the necessity for adequate repair departments. New York maintains well-equipped shops where not only worn and damaged apparatus is repaired, but new apparatus is given careful and practical tests before purchase.

Photograph by Paul Thompson

PUTTING A NEW MOTORIZED WATER-TOWER INTO ACTION IN NEW YORK

The most precious moments in combating a fire are those before the flames have had time to spread. The reduction of time in getting to the scene after the alarm reaches the engine-house, by the substitution of motorized for horse-drawn apparatus, has resulted in checking many a potential conflagration.

Argentina and Australia developing in rapid strides, the American farmer must become a more efficient producer to meet their competition, which has much more to do with the present low prices of farm commodities than most people realize.

In those countries cheap lands produce large holdings and vast fields, where production costs per bushel can be driven down by highly organized power farming.

POWER FARMING AND PRODUCTION

Experience throughout the tractor farming belt shows that if the farmer values his labor at current rates, it costs less to sow and reap an acre of wheat with tractor-drawn equipment than with horse-drawn. Experiment-station records in our Western grain belt present striking illustrations of this. The reduction in labor costs goes down much faster than equipment and maintenance costs go up.

But that is only the beginning of the story. Power farming and horse cultivation of identical tracts in Kansas resulted in eleven years in the production of eight bushels of wheat on the power-farmed tract for every five on the horse-tilled land.

The secret of this success of the tractor over the horse was that, with the former, the land could be plowed seven inches deep in July, while with the latter, owing to the heat in midsummer, it had to be plowed five inches deep in September.

As the July-plowed soil contains one and a half times as much moisture as the

A REMINDER OF THE TIME WHEN GRAIN WAS SOWN BROADCAST

Handpower gave way before horsepower a generation ago; and now, in its turn, horsepower is facing a formidable rival in tractor power (see illustration, page 414).

DRAGGING OUT STUMPS IS ONE OF THE MANY JOBS ASSIGNED THE TRACTOR WHEN THE "BUSY SEASON" ON THE FARM IS PAST

CLEARING NEW GROUND WITH A TRACTOR

Five acres per day can be cleared with a thirty-horsepower tractor and a twenty-four-inch plow. The reader born on a farm will doubtless remember the time when the brush this machine plows under had to be grubbed out, piled and burned, and the ground "ripped" up with a "bull-tongue" shovel plow.

A "COMBINE" AT WORK ON A CANADIAN FARM

This machine cuts, threshes, and delivers to the wagon alongside more than 100 acres of wheat a day. Many elderly people can remember the grain-cradle and hand-flail era, when it would have required the labor of some three hundred men to do the same work in the same length of time, to say nothing of the twenty-eight horses required to haul in the crop. Even the binder and the threshing-machine would call for about sixty men and forty horses for cutting, hauling in, and threshing a hundred acres of wheat in a day.

BONANZA FARMING IN CANADA

This picture of operations in a seven-thousand-acre Canadian wheat-field shows the character of the competition the American farmer must meet in the future. One tractor and six men do the work of twenty-eight horses and fourteen men, with horse-drawn binders. The high cost of labor will do more than any other agency to bring about lower production costs on the farm by necessitating an increased substitution of machines for hands.

DISK-PLOWING THE RICH PRAIRIE SOIL OF THE MIDDLE WEST

The thousands of quarter-section farmers do not make interest on their investment, much less a profit, with dollar wheat. The large tract, with power-farming methods, can show a profit, even at such a price.

Photograph by Kaufmann & Fabry Co.

PUBLIC PARKING SERVICE IN THE RECLAIMED GROUND ALONG MICHIGAN AVENUE, CHICAGO

The vast demand for parking space in Chicago is met by the establishment of a public outdoor garage, where cars may be checked for a nominal fee. The motorist gets a check, and the car is not released except upon its presentation.

TRACTOR-SEEDING ON AN UP-TO-DATE FARM

Contrast this picture with the one on page 408 and note the progress a single generation has wrought.

September-turned, and as deep plowing turns up more plant food than shallow, it is easy to account for the difference in yield.

These examples of lowered per-acre costs for cultivation through the elimination of high-priced labor, and increased per-acre yield through better methods of cultivation might be multiplied indefinitely.

THE DAWN OF A NEW ERA

We stand on the threshold of another transformation in farm life, as significant and as far-reaching as that which took place when the farmer laid away his scythe, grain cradle, and flail for the mower, the binder, and the threshing machine.

By substituting machines for hired hands, the farmer will lighten his heaviest load—high labor costs.

When the versatile utility tractors that are now ready to come on the market make their bows, the farmer will settle the labor question as he settled it with his binder and mower.

He will discover that he can so decrease his labor cost and increase his acre yield as practically to make two dollars grow where one grew before.

The substitution of power for horses will mean millions of people released from agriculture for industry, as was the case when the farmer substituted horses for men.

With more urban mouths to feed and backs to clothe, and fewer rural ones to provide for, a new day will dawn when the efficiency of the factory will come to the farm, and then the American farmer can do what the American automobile maker has done—meet the competition of the world and still make money.

And when the noontide of that day is reached, the great triumvirate — the passenger car, the freight truck, and the farm tractor—are destined to write a record of service to America that will stamp the automobile engineer as one of the foremost contributors to human welfare in all the history of mankind.

THE EMPIRE OF THE RISEN SUN

By William Elliot Griffis

The appalling calamity which befell the Japanese in the destruction by earthquake, fire, tidal wave, and typhoon of the capital city, Tokyo, and its seaport, Yokohama, as well as other centers of population, on September 1, has not daunted this industrious and resourceful people. The same qualities and characteristics which Dr. Griffis, in the following article, sets forth as responsible for the rise and development of the Japanese will enable them to build a new and greater capital upon the ruins of the old. The fortitude of the island kingdom of the East in the face of unprecedented disaster has commanded the admiration of the entire Western World.—The Editor.

JAPAN'S SUN has risen and her "century aloe flowers to-day." Nevertheless, while to the world, almost dazzling as has been her uprising, as of a new sun to the zenith and to world power, the causes have been psychological rather than material and from within more than from without, and there are men of centuries gone who deserve equal honor with those of our time.

Two documents lying on my table tell a story of what once seemed in earth's garden a plant not only "born to blush unseen," but even to die without flowering; yet within the lifetime of one man Japan has become the wonder of the world.

The official Résumé Statistique de l'Empire du Japon, 36ième Année—that is, in the 11th year of the era of Taisho (Great Righteousness)—in two hundred pages of close print, shows Dai Nippon an empire of sixty-five millions of souls, alert and advancing in every line of human endeavor. By contrast with 1870, the story of prosperity and national expansion reads like a fairy tale. One does not need a Gladstone to "make figures eloquent"; eloquence is here.

The other document is the report of the Fukui Silk Textile Association. When I first saw this interior city in a feudal fief, it had not a single chimney. It is now the center of the habutai (feather-woof) silk production.

In place of castle moats, privileged samurai wearing two swords and the despised merchant having little or no social standing, Fukui is now a typical industrial city, with electric lights, steam power, and modern appliances in factory and home, and her young men are ambitious to make fortunes in industry.

Osaka, once chimneyless and a wilderness of one-story houses, is a forest of smokestacks, with mills, imposing steel-jointed business structures, shipyards, foundries, and factories.

With population more than doubled, with wealth increased twenty-fold, and transformed from an almost forgotten hermit nation into a world power, a leader in industry and commerce, with an ambition to be second to none in capturing the markets of the world, it is well for us to look into the causes of Japan's evolution and triumph.

Yet in accounting for such outflowering within the last half century, "as if a lily blooming in the midst of the salt ocean," there are those who have all along refused to be surprised. They know that the lotus does not grow in brine, but that even the pond lily has unseen roots in the mire far down below.

In mythology, Minerva leaps full-armed and radiant from the brain of Jupiter, but in actual history, the Buddhist philosophy of Ingwa (Cause and Effect) is sound.

NEW PHILOSOPHY REPLACED CONFUCIAN CULT

For Japan's development, there are reasons both internal and external. First and greatest of all was the new mind created long ago by the Oyoméi (intuitional-pragmatic) philosophy, which threw the reactionary Confucian cult into comparative shadow.

In this mental discipline it should be noted that every one, without exception,

TWENTY-FIVE-SEN STORE IN YOKOHAMA: ONE PRICE BUT TWO LANGUAGES

Japanese stores are rapidly getting away from the bargaining methods common in the Orient and in several cities there are one-price guilds which maintain a standard charge for goods. A 25-sen store, corresponding to a sixpenny bazaar, deals in a wide variety of articles worth about 12 cents in American money.

of "the fifty-five creators" of the New Japan were trained, and some proved to be past masters. Without this element, the Japan we now know would not, could not, have been. Introduced from China, in the seventeenth century, the philosophy of Wang Yang-ming (Oyoméi in Japanese) was developed and taught by book and expounders in fifty different centers.

Two hundred and fifty years of peace sufficed for the accumulation of the nation's potencies in preparation for outburst, when the opportunity should come.

SEEDS OF DUTCH CULTURE SOWN EVERYWHERE

During all this period there was unbroken contact with Europe through the Dutch at Nagasaki. Even the Portuguese and Spanish contacts of seventy years, with merchants, military men, and engineers, had left their mark on the Japanese language, architecture, music, military science, and dietetics. Then, from the Dutch, with their mechanics, physicians, language, books, apparatus, and hospitals, such wonderful results were wrought in art, science, invention and trade, in ideas and commodities, that Swift, through his knowledge of Holland, was able to pen his extravaganza, "Gulliver's Travels."

When, in January, 1871, the writer began his work in the Imperial University, in which were students from all the provinces and from every one of the 280 feudal factions of the empire, he secured scores of autobiographies. By means of these and later by travel and research, he found that Dutch culture had been like seed sown everywhere.

A thousand spots of light foretold the coming dawn of a long bright day. Hundreds of native physicians read the noble Dutch language and in a measure practiced European medicine. At Nagasaki, Dr. Pompe van Merdervoort had established a hospital and trained physicians, while Dutch mechanics, with the aid of Japanese workmen, had built a steam yacht.

On the streets and in the drug shops, I noted (printed in Dutch) nostrums and patent medicines from Rotterdam, and (by logical connection?) in the cemeteries found epitaphs in Dutch. Being a teacher of chemistry, I recognized, for example, in "raude," laudanum (no *l* in Japanese), one of a long list of drugs and chemical substances imported in their popular form from Europe as old staples.

In a word, Japan was as a rich clover field already pollenized from the Occident. Like a steady line of bees, the Dutch ships had been bringing the vitalizing influences for more than two centuries. Yet to the Japanese, the modern revelations, on a large scale, were the "black ships" of the American whalers that gathered in their waters. What the islanders learned both from honestly shipwrecked sailors and from the voluntary waifs (chiefly mutineers) quickened the national temperament.

Ranald MacDonald, from Sag Harbor, New York, in 1848, had himself cast ashore and was honored as a teacher at Nagasaki. In his hotellike prison, he trained a dozen interpreters and had them well prepared in good time for Perry's advent. He was aided by Nakahama Manjiro, a Japanese educated at New Bedford, Massachusetts, who had been picked up at sea as a waif by an American captain.

AMERICANS BROUGHT WESTERN IDEAS AND INVENTIONS

President Fillmore's fleet, which was ordered to sail for the East in 1852, on the same day that Japan's greatest emperor, Mutsuhito, was born, consisted largely of store ships, which were loaded with American inventions and products.

After Commodore Perry had completed his treaty-making, there was held, in 1854, on the strand at Yokohama, Japan's first industrial exposition. In 1872 I saw the more ornamental presents in the storehouse at Shizuoka, the place of the last shogun's banishment.

The things of use, in agriculture and the arts, had already been widely distributed and copied, especially in that new part of the empire called the Hokkaido (Yezo), which throughout bears a very American aspect; and the reason of this is clear. A commission of scientific and practical men, sent out from Washington, D. C., was active in the island during the decade between 1870 and 1880.

Even more impressive to the student of Japan's evolution were the personnel and equipment of at least five of the first American missionaries. Three, besides

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BIRD'S-EYE VIEW OF MIYANOSHITA, JAPAN

This Japanese town, which was noted throughout the Hakoné district because of its excellent hotel accommodations, fresh air, and beautiful scenery, lay in a wide, level tract in the valley of the Haya-kawa, 1,223 feet above sea-level. A part of this city was thrown down a precipice during the great earthquake. Many of the members of the diplomatic corps and foreign residents in Japan were at summer resorts in the Hakoné district at the time of the Tokyo-Yokohama disaster.

being mature in experience, had been long before in China, or were men of science and technical ability. Dr. J. C. Hepburn opened a hospital and dispensary and trained the first surgeons and physicians, and he and S. R. Brown, as Pontifices Maximi, built the bridges spanning the gulf between the two languages, with their grammars and dictionaries. They also trained the intellectuals, and introduced likewise photography and the finer arts.

The third, G. F. Verbeck, was a marine engineer and master of seven or eight languages. For years, when the Gospel was still unpalatable, he taught the Japanese everything they wished to know. Then he organized their university, taught them the spirit of occidental law and custom, explained the freedom of the press and how church trustees held property. He also proposed the great embassy of 1872-4 around the world to study the details of Western civilization, half the personnel being chosen from his pupils.

Moreover, even from 1860 to 1875, scores of American schoolbooks had been translated into Japanese.

THE YOUTHFUL NATION SEIZED UPON NEW THINGS

Back of all was the nation's youth, with its vigor, its innate capacity to select, adopt, adapt, and become adepts. Both geologically and in human history, Japan is the youngest country in Asia.

From 1859 to 1868 not a few foreign helpers on the soil gave their time and talents to aid Japan; but after 1870 and until 1900 and later, Argonauts from the West came in fleets to cover Japan with a golden fleece. No fewer than five thousand *yatoi* (salaried foreigners), experts in every line and field of human endeavor, were called out and employed. From $28,000 to $1,000 were the salaries paid to these teachers, advisers, and technicians.

These men started the first railways, telegraphs, lighthouses, navy yards, foundries, mercantile projects, mechanical inventions, appliances, and agencies. I had the honor of starting the first school for manual training and technical art and science.

Yet the Japanese already had the capacity and ambition. We aliens were only the guides, helpers, and servants. An American missionary, Jonathan Goble, invented the jinrikisha, that has rolled round the world. Nevertheless, let me repeat it, we yatoi (I being the first to arrive of those called out under the Imperial Charter Oath of 1868) did but teach the rudiments and point the way. It was the Japanese who made the New Japan.

When feudalism had been abolished, in 1871, and the once-despised merchant was given honor and opportunity, he unfolded the pinions of a towering ambition and looked abroad to capture the markets of Asia. It was "like giving wings to a tiger."

At a secret conclave in Tokyo, in 1870, of the leaders of the Revolution of 1868—unchronicled in history or official documents, but reported to me by Dr. Verbeck, who was present as umpire—the real problem, long debated, was this: Shall Japan be a nation of samurai and soldiers, or of merchants and industrials, and, in the main, the men of modern mind? Okubo, Okuma, and Shibusawa gave their lives to the uplift of the once-submerged class, now on the crest of the wave—the merchant and manufacturer.

Yet national defense was not forgotten. As early as 1860, young men had been sent to Holland for naval education; but it was under British officers that the imperial navy was reconstructed, while French first, and then Germans, recreated the military system. (Admiral Togo was for twelve years under British naval instruction.) To Americans was given the task of national education, methods of finance being borrowed from Belgium.

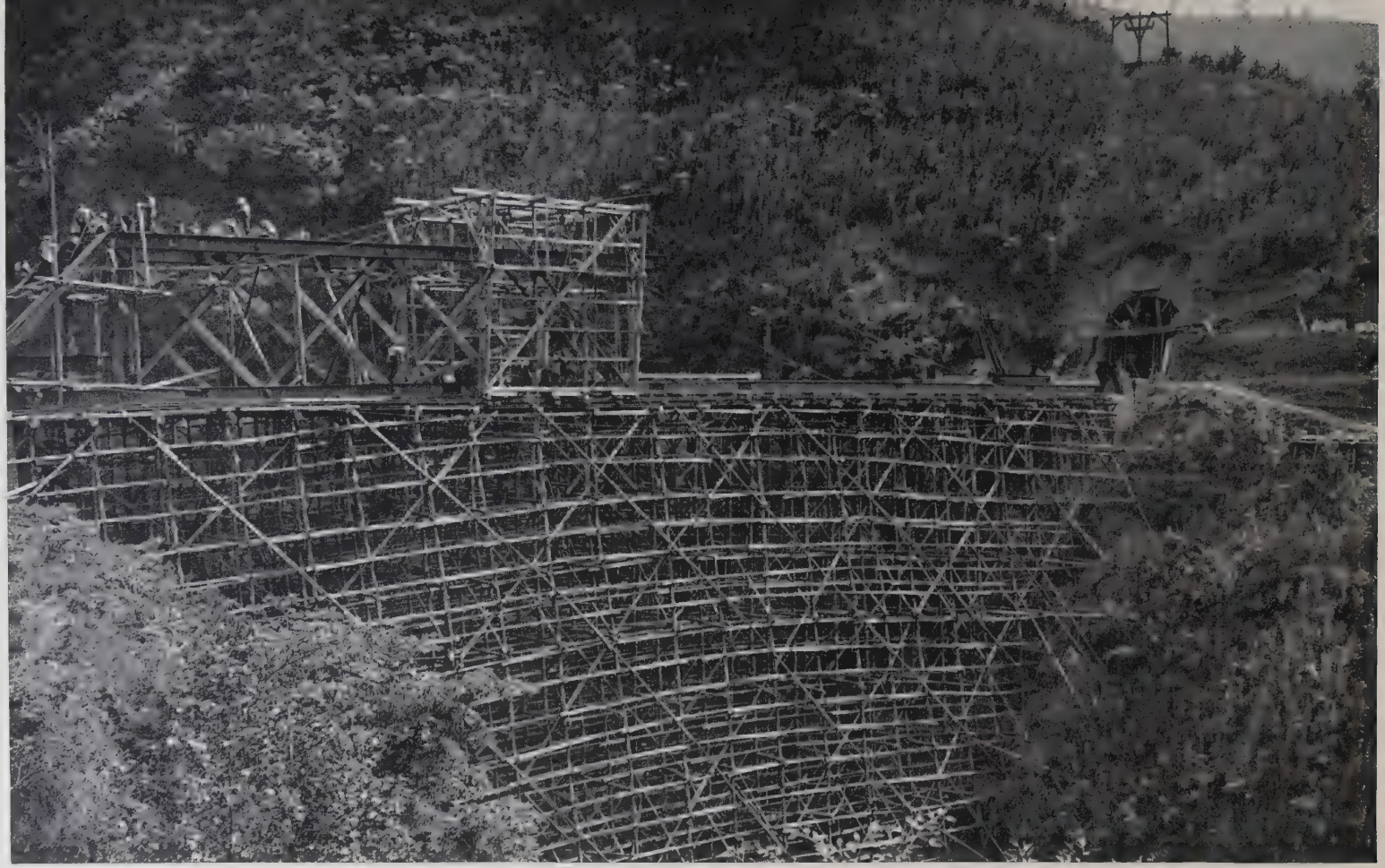
JAPAN'S FOUR GREAT MEN OF THE RECONSTRUCTION ERA

Of the four greatest men of 1868 and the reconstruction era, from 1868 to 1900, Okubo was the master spirit. It was he who had the capital changed from Kyoto to Tokyo and the Mikado brought down from the purple clouds of mystery and pseudo-deity to be a human ruler. Okubo infused into the Japanese the spirit of conquest of the world's respect by means of peace rather than by war. He was the brain and pen of what was not only Restoration but Revolution, and his

Photograph by C. H. Kragh

A THEATER STREET IN YOKOHAMA

Both the theater and racing have been popular amusements in this, one of the oldest and largest trading ports of Japan. It was opened to the world in 1859 by Commodore Perry. At that time it was only a fishing village with 87 dwellings.



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REPLACING A JAPANESE BAMBOO RAILROAD BRIDGE WITH A STEEL STRUCTURE

Although the island kingdom of Asia now has 7,000 miles of railways, the first line, 18 miles long, from Tokyo to Yokohama, was built only 51 years ago. One of the greatest engineering feats of modern times is the tunneling of the Moji-Shimonoseki Strait, separating the island of Kyushu from the main island of Honshu. The work was begun in 1920 and will be completed in 1928. The tunnel will be seven miles long, one mile of which will be completely under the sea.

Photograph by Mrs. Jane Watts Fisher

BUYING POTATOES IN MIYAJIMA

The island of Miyajima, in the Inland Sea, is one of the most beautiful in Japan and also one of the holiest of the many holy islands in the Japanese Archipelago. It is dedicated to three Shinto goddesses, daughters of Susa-no-O, the Sea King. Human beings are forbidden either to be born or to die within its sacred precincts. The island's temple and its *torii* are famous in Japanese art.

son, Baron Makino, was heard from at Versailles.

Kido was the constructive statesman, with original ideas of which Ito was the executive, the motto of the latter being "Get it done and let them growl."

Iwakura, of immemorial noble lineage, was the link between the emperor and the high-souled parvenus, who did with the throne and court pretty much what they pleased, and in time changed theocratic despotism into constitutional monarchy.

FRIEND OF MERCHANT CLASS FACED ASSASSINATION

When the embassy returned from its world tour in 1874, there was a terrific struggle in the cabinet. It was to decide that Japan's path of progress was to be in the line of industrial enterprise rather than through war or territorial conquest. Okubo and the men of peace and development through industry won.

Hardly less of a revolution than that led by the four great men already named was that in finance and in education. We all expected Shibusawa would be assassinated (as a majority of the greater leaders were) when he pronounced in favor of modern bookkeeping and dedicated his life to elevating the once social outcast, the merchant. He cleared the way for Matsukata, who secured the adoption of the gold standard, even when Great China issued no coins valuable enough to be worth counterfeiting. This enabled Japan to gain and hold credit in the world's finance.

Tanaka, backed by Kuroda, fought to a finish the fight for the equality of female education in the scheme for national elementary instruction, when, in 1872, he called Miss Margaret Clark Griffis to begin the first school for girls.

Only the learned, in 1870, could by ear or eye read anything higher than shop accounts or tawdry fiction. All erudition was in the hieroglyphics of China.

READING DURING A LULL IN HIS TRADE

After a long sleep of centuries, young Japan is now wide awake, and no other country can boast such rapid strides in so many directions. Adopting quickly the forces of Western civilization, its people set themselves the task of modernizing their country in one generation, with such success as to astonish the world.

It was said by aliens first tackling the Japanese script and style of speech that there were seven distinct languages in one. At times Japanese gentlemen in conversation seemed to have graduated from an old-time school for the deaf, for they used their fingers and the palms of their hands most industriously to show just what ideographs they were using or the meaning they wished to convey.

A reform in this direction meant the uplift of humanity and the manifold increase of the nation's resources through productive individual ability. To my mind, these facts explain the national renaissance better than official statistics, imposing as these figures of millions are, or even the present-day reports of trained alien journalists.

Briefly stated, Japan is likely to keep up with her competitors in the race because of her previous preparation, and, now that she has accepted the proposals of the Washington Conference, she is likely to gain her "second wind."

"Education is the basis of all progress," became the motto of the nation fifty years ago. With the old Chinese characters, where a single sound might have, in writing, more than 200 different meanings, we can see the necessity of the finger-play referred to.

SETTING RICE

Nearly one-fifth of the farm land of Japan is devoted to growing rice. The area under rice has increased 80 per cent in the last 35 years, and is believed by some authorities to have reached its maximum. Irrigation is universal in the cultivation of paddy fields, and farming communities frequently combine to install a pumping plant. The rice harvest usually takes place in October. This grain, besides being the staple food, is the basis of *sake,* chief alcoholic beverage of the Japanese.

The new education uplifted a whole nation. Almost every village and hamlet pulses with new life. The victories, both over China and Russia and in the world's markets, were won first in Japan's public schools. In 1920 these numbered 25,644, with 178,450 teachers and 8,362,992 pupils—an almost unparalleled record, even in the Occident.

In all this there is a living parable. In Old Japan, man was too much like a beast, while the beast was too much like a man. Herein are the patent facts. For ages, and even until to-day, Japan has suffered from too much hand labor. She needs more live animals at the plow and in the fields, the streets and the mills, while she needs to uplift her men and women.

The common term, or numeral, in the old language for the laborer was the same as that for beasts of burden. Buddhism inculcated exceeding kindness to animals, but hardly, in proportion at

Photograph by A. Nielen

CUSTOMARY TRANSPORT IN RURAL JAPAN

Such conveyances are drawn by men, rather than horses. The Japanese horse is not used to any great extent for transportation purposes. In agriculture they are now used more than cattle, but live stock of any kind is scarce on the average Japanese farm (see also text, page 427).

least, to men. Japan taught us to rear monuments in honor of steeds slain in war, but it was Christianity that insisted upon more care of men. No such thing as a public hospital, in the modern sense, existed in Old Japan.

"WHAT WILL THE GRAVEYARD SAY?" IS THE NATIVE'S QUERY

Of Buddhism's indoctrination of a whole nation, one meets with noble and pathetic, comical and ludicrous examples every day. Men, while drawing or pushing carts—the work which horses ought to do — will, even with every muscle strained, turn several feet out of their way in order to save a mangy dog or chicken, big or little. Devoutly they abstain from crushing out the life of a living creature, through whose body the soul of some ancestor may be transmigrating.

Many a theme of grave debate and high diplomatic significance is powerfully influenced by the fear of ghosts. Unconsciously, the native asks, "What will the graveyard say?"

But why should Buddhism of itself care so much for "red earth" (the human body), when this is only one link in the endless chain of evolution up or down? Buddhism knows no such thing as an individual human soul, or a self-conscious, indestructible human spirit, but only each human being as the end of a long line of evolution through *ingwa* (cause and effect), with no God or Creator at either end of the line, except, possibly, an abstraction of force.

Why, therefore, should man more than brutes be cared for?

Such is the inquiry that springs in the brain of one born and reared in the atmosphere of the personality of Deity and the individuality of humanity.

BUDDHISM RAISED IMAGES; CHRISTIANITY BUILT HOSPITALS

Buddhism covered Japan with images, but Christianity built the first hospital. The Daibutsu (Great Buddha) at Kamakura, excelling as to its material and proportions all other bronze work on earth,

Photograph by Kiyoshi Sakamoto

FAN-MAKING IN JAPAN: DRYING THE "BONES" OF THE FAN

Regarded as an emblem of life that widens as the sticks radiate from the rivet, the fan is selected by the Japanese as a New Year's gift, and it is one of the gifts the bride takes with her to her husband's house. It is given to a youth upon the attainment of his majority, and is used as a signal by umpires of wrestling matches and by jugglers in feats of skill. Upon the presentation of a male child at birth to the temple of his father's deity, he receives two fans, while a girl is given a cake of pomade to bring good looks.

is a noble memorial of the man who has conquered his passions and lives in the calm of absorption in the soul of the universe.

Yet, in this embodiment of passivity, who could look for a true symbol of the New Japan, which was born after quickening from the West? Christianity comes with its democracy (so relentlessly opposed by lingering feudalism and so hated by the aristocracy and the general staff), its schools, colleges, hospitals, and its command, "Do." It wages eternal war against that Invisible Government which, besides being Japan's greatest curse, has been stronger than Mikado, diet, premier, or people.

Christianity rebukes that excess of reserve and that love of secrecy which have made Japan the object of suspicion everywhere, and which in individuals so tries the patience of their foreign friends.

Throughout Japanese history runs the stream of impersonality. In literature and in government the lack of individuality and the chronic difference between appearance and reality everywhere confront the student. If there be any place where "things are not what they seem," it is Japan; but most especially in her political life.

What has really made the New Japan is this emergence in social life of the new spirit of personality and of individuality. The old civilization was communal. The new national life is based, in the main, on the assertion of the inherent powers of the individual, yet in unity of purpose with the commonwealth.

The real Japanese of old was mostly agricultural, piscicultural, and marine; but to-day, instead of cottage industries, we have big business concerns and a vast population in mills.

Even yet, however, the Mikado's Empire does not consist, in the main, of travelers and bankers abroad, who use perhaps more than one language, wear swal-

low-tailed evening dress, and number five millions or so. The real Japan is made up of more than fifty millions of men and women in the countryside, in the mud of the rice fields, or along the seashore as fishers or junkmen, or of those who within a decade or two have crowded into the towns; for the industrial revolution is the greatest of the many through which Japan has passed.

Yet all this is out of proportion to the numbers of habitations amid fertile fields which are not, but could be, improved in the matter of soil production.

In Japan, how scanty is the live stock, how few, except as pack animals, are the horses! The milch cow is a rarity and the traction horse the exception.

MORE FARMERS NEEDED

Where China suffers from having too many farmers, Japan has relatively too few of the right sort.

With more than double the population of 1870, all checks having been removed, New Japan is too much an affair of cities and towns, with not enough soil improvement.

One can say this with truth, even with the figures of the last published census of 1920, in the digestion and publication of 1922, before him. Although in large cities and along the railway lines one sees milk bottles and wagons, there are not, in Japan proper, as many as 1,500,000 head of cattle; of horses there are somewhat more than that number; of sheep not 5,000; of hogs not 400,000—that is, there are but 24 cattle and 27 horses to every 1,000 people.

All this reveals a situation which requires hand labor in a disproportionate degree. Only in the Hokkaido, which is rich in live stock and notable for the application of ideas and things formerly unknown, but introduced by Americans since 1872, does one note a striking difference.

Japan needs a few million more cows, and horses that are able and willing to pull anything. If sheep are to be able to live and multiply, to furnish food and textile materials, the bamboo scrub must be pulled up. Grass rich in food material is the blessing of the temperate zone, and Japan might have it if she would.

These changes, with generous chemical alteratives and artificial fertilizers, would recreate Japan's soil, uplift labor, im-

A TELEPHONE OPERATOR OF TOKYO

During recent years the high cost of living forced thousands of Japanese girls from their homes into industry. There are now more than 12,000,000 girls and women at work, great numbers being employed in the telephone service and in the government postal and railway offices. In general, their hours are very long, running from ten or twelve to fifteen hours. Japan also has a child-labor problem, and there are many girls under twelve and fifteen years of age employed in factories.

Photograph from Centenary Committee, M. E. Church

JAPANESE CHILDREN WITH THEIR NATIONAL FLAG

One can always see children and flags in Japan, and it is the attractive youngsters dressed like dolls, and the red and white sun flag that give color to much of the patriotism for which Japan is renowned.

prove the countryside, the homestead in its exterior surroundings, and the interior of the house.

DRAB PEASANT LIFE RELIEVED BY PILGRIMAGES

The drabness of peasant life in Japan has been and is relieved chiefly by pilgrimages; yet in the career of Lafcadio Hearn, whose amazing powers of mind and pen were used to idealize Japanese existence, we have both a parable and a revelation. His later awful revulsion of feeling affords the parable. It was "Hail" and a "kiss," with "grace, mercy, and peace," at first. It was "D—n the Japanese" at the last. Yet whose fault was this? His first books border on the lackadaisical. He wrote panegyrics. His last one, "An Interpretation," it would pay a missionary society to subsidize.

Surely one can be loyal to his own race and civilization without either glorifying or laying anathema on the Japanese as a "lesser breed," or denouncing wholly their systems, social or political.

To some minds, Lafcadio Hearnism and Pierre Loti-ism work immeasurable injury to Japan by mental recoil and reaction. Myriads of tourists (averaging 15,000 a year), "fed up" on these authors, come to the shores of Nippon to behold

and enjoy; yet, also, to taste too often Dead Sea fruit; or to find, instead of visible facts, only "the baseless fabric of a vision."

Such mischievous idealization of a people is like that of making an angel—of the stained-glass notion and pattern — of woman, and then discovering she is human.

The "mid-Victorian" Japan, thus glorified, has now given place to the South Sea Islands as a subject to be transfigured by authors reveling in sensuousness with captivating style. Hence, the rush thither of young men, sensualists with or without wealth. In the early Meiji days and before, Japan was as full of these adventurers as are the proverbial woods of Mississippi with the children of the colored folks.

But to return to our muttons, to our cows and to our horses. Such an animal as a milch cow, of the sort with which we are acquainted, was unknown to the Japan of 1870. A sheep was an extreme rarity. But now there are apostles of the new gospel of pasture and fields for the wool-bearing friends of man. These are both students and practical men, who have mastered the literature of the subject and have studied the economic side of the great enterprise, which made England rich and the woolsack a seat of highest honor.

Learned in the matter of diseases and dangers in the case, these men proceed to eradicate the bamboo scrub, which, in the sheep's stomach, cuts to pieces its digestive canal.

TWO MEN REQUIRED TO MILK A COW

Sadly missing from Japan's literature are the rich imagery and appeals to the imagination of the shepherd and shepherdess, and from her dietary the realities of "lamb, ram, sheep, and mutton," besides the loss to industry, trade, and the landscape. To multiply sheep in Japan will be an enormous gift to Japan's civilization. She needs the ram's horns and the ewe's udder in her cornucopia, which locally is in the form of "the rake of prosperity" usually associated with the happy old couple of Takasago.

When one American lactifer was imported, two strong Japanese men were selected as "milkmaids," the male sex and muscular strength being important considerations.

The fluid extracted proved to be the fountain of life to a boy suffering from marasmus — a case which had proved hopeless under the Japanese physician's hand. After critical examination, our Dr. Hepburn advised a pint of milk three times daily, but nothing else different from ordinary diet. The youth's health was resurrected, and he is now in his eighty-eighth year.

But in 1870 no native cow would allow liberties to be taken with her, and two men might work an hour before they got a quart of milk; for public opinion in the bovine world was not in favor of milk for human beings, except possibly for very old people and infants. This opinion was shared by human beings quite generally.

HORSES REBELLED AT LABOR

In 1870, also, no native horse was in use, except for pack or saddle work. Men went barefoot and pulled or pushed the cart. The horses wore straw gaiters and drank out of dippers filled by men; but traction was beneath their dignity. The muscles of the *uma* were not developed for horizontal work.

When to my friend, R. H. Brunton, the English engineer and lighthouse builder, was assigned the task of laying out the streets and making the curbings, culverts, gutters, and pavements of Yokohama, he took it for granted that the Japanese horse would coöperate with him.

Vain thought! He, supposing that horses at the ends of the earth were of the same temperament and utility as British nags, sent to London for a set of the best English harness. In his home, men and their four-footed friends were so well acquainted with each other that those on four feet could push, pull, carry weights, bear burdens horizontally as well as vertically, and even leap fences and tread mills, up or down. Why not their cousins overseas?

In this course of reasoning, however, Brunton reckoned without his stallions, as they all were in this assigned region of the Land of the Gods, for the whole country was mapped out in lines of demarcation that kept the genders apart.

JAPANESE FACTORY GIRLS WORKING WITH COCOONS

The yellow silk filature cocoons are placed in hot water to loosen the silk and to facilitate the unwinding. A pound of raw silk requires from 2,500 to 3,000 cocoons, each cocoon furnishing a filament of perhaps 600 yards in length. The work of 5,000 silkworms is needed for one kimona. In the silk factories, Japanese girls receive from 15 to 20 cents a day. Japan is the world's largest producer of raw silk, for which the United States is her best customer. Before the earthquake Yokohama was the clearing-house for this product.

When he attempted to try the new equine toggery on the native beasts, the result was a surprise and the end an experience. An equine brainstorm, with legs and feet active in every direction, frustrated British benevolence and enterprise. No respectable horse, in the land where the horse was sacred, worshiped, and kept in the temple stalls as a divinity, would humiliate and degrade himself by labor that was fit only for men!

So Brunton had to rely wholly upon hands, and Yokohama was graded, dressed, and finished with human labor alone, while the laughter of the equine deities was more real than metaphorical.

JAPAN'S SOIL CAN SUPPORT TWICE THE PRESENT POPULATION

Despite the fact that the Japanese have been "farmers for fifteen centuries" and the Chinese for forty, there are some elements of success now counted among us as the *a, b, c* of agriculture, such as the selection of seeds and stock, which as principles were virtually unknown among the Japanese in old days; nor has the handful of professors and scientific men in Japan to-day as yet greatly altered the situation.

From what I saw during four years, I believe with others, who know a thousand-fold more on the subject, that Japan's soil, when properly treated, can furnish food for a population at least twice as great as is now there; and that the importation of food, except in the fancy and not staple elements, may be rendered unnecessary.

In spite of the plethora of statistics of visible progress, I cannot but think that the idea of some of her statesmen, so often reiterated as to become a dogma, that Japan must continue wholly in maritime and industrial expansion, depending on the Asian continent for her raw material, thus tempting the nation to delusive enterprise and to hostile aggression, is a mistake that invites ultimate disaster.

Such a notion has certainly made the

Photograph from Kiyoshi Sakamoto

THE TENSE MOMENT BEFORE A JAPANESE WRESTLING MATCH BEGINS

They have stamped their feet, eaten their salt, rinsed their mouths, slapped their knees, and are waiting the signal to clinch. The distinctly Japanese type of wrestling, known as jujutsu, became popular in Japan in the sixteenth century, having been introduced by Akiyama, a noted physician, who learned it in China and elaborated greatly on the original methods. It has always been semi-secret in character, being taught only after the pupil has taken an oath not to reveal the knowledge. A master in the art can by a slight, quick movement break a man's neck, ankle, dislocate his hip or shoulder, burst or twist a tendon, or benumb his brain.

world suspicious of Japan as "a neighbor-disturbing nation," if not as a pride-swollen marauder.

In reverse of this idea, my conviction is that, for ultimate benefit and solid prosperity, Japan should strengthen the foundations by further uplifting her people, improving her soil, and developing her innate resources. The admiration of the world for her military and naval triumphs all too quickly changed into suspicion, envy, and hatred. Her nobler racial, esthetic, intellectual, and moral qualities will ever gain the confidence and win the increasing admiration and respect of mankind.

JAPAN'S ENTRY INTO THE ARENA OF WORLD TRADE

Having faced some of the shadows on Japan's dial, we may now glance at the full sunlight of her prosperity and look into some of the reasons for it, with hope for its continuance.

Both the age-period and the manner of the double summons to Japan to awake to new life seem unique in human history. In a word, time and circumstance wrought in harmony. From within, through long mental preparation and the call of noble souls, and from without, by the forces of the westward movement of the race and by direct American impact, Dai Nippon received her mandate. This came at a time when the forces of nature and the appliances of civilization were at their highest.

With the momentum gathered during more than two centuries of peace, the Japanese utilized and applied these new forces at once. In a word, they leaped like athletes into the arena to meet the clash of industrial revolution, and even dared to face competition with the older manufacturing nations.

Until about 1750, man had invented nothing greater than himself. Thenceforth, from Franklin's and Stephenson's era, he began to harness the potencies of Nature and to make the mystery of electricity and what he called steam serve him.

Hence Japan, doubly alert and equipped by long inward intellectual discipline and through the prolonged stimulus given by the Dutch, by Commodore Perry and Townsend Harris, and by the 5,000 foreign teachers of every sort, grappled at once, as competitor, with even the greatest of nations.

The ancient proverb of "the hermit in the market-place" became a reality. Transformed, in a generation, from an island recluse to princely magnificence, Fair Japan became also a Rasselas with new hope and ambitions, but also with novel perplexities and unexpected problems.

JAPAN SERVED A LONG APPRENTICESHIP

I feel quite sure of the truth of my assertion that the victorious and sanguine young men of 1867, most of whom I knew fairly well and who later became the genro, or elder statesmen, had colossal expectations. A decade or so would suffice, they thought, to transform Japan into a fully equipped modern nation; for with Yamato Damashii (the spirit of unconquerable Japan), transmitted in unbroken succession from the Age of the Gods and then in volcanic outburst, what obstacles could not be overleaped? In self-belief and self-assertion, none can excel the normal Japanese—unless it be an American. "They can, because they think they can."

In the world outside of the chain of islands at the ends of the earth, this vision paled and vanished before the light of common day, and the project utterly fled before experience. Yet Japan was in many ways saved the long apprenticeship of European nations, because, even more than the hero of Locksley Hall, she soon found out that she was "the heir of all the ages, in the foremost files of time," and was able at once to utilize in fullest efficiency the grains of the centuries and the resources of Western civilization.

Hence, within a single lifetime and in some instances within a decade, the adoption of new political and social systems, post routes, telegraphs, telephones, steamship lines, and modern costume!

In illumination, no slow processes from a saucer of oil and a pith wick to Drummond light or Mazda! With the affluence of water power, already at hand in a chain of islands thrown up by volcanoes, rich in mountain ranges with innumerable branches and spurs, where precipices and waterfalls were uncounted, the story of Prometheus was thrown into shadow. Chained to a thousand rocks were the electric lights of beacons that made a shining path in the ocean along a once dangerous coast.

With this fire stolen from heaven, the great cities, instead of their streets, as of old, showing a myriad of dancing, colorful lanterns at night, now have, row upon row, long miles of iron standards holding the incandescent arcs, while in the common business of catching thieves and draining mines and swamps, the electric current is kept ever busy.

To those with memories of the early seventies, the old fairy tales of power, as displayed by imps and dragons, seem outdone in the pragmatic statistics of 1920.

For cooking, lighting, heating and motor power of all sorts, there were in that year 1,333,243 kilowatts harnessed to human service—a figure vastly increased in this year of grace 1923 and of the Japanese Empire, as officially stated, the 2583rd.

One commercial envoy, who after a visit to Japan had failed to "land" a big order, returned to America with only blasphemy of the Japanese, classifying them among the worthless and the damned. Another, who brought back an order for millions to the electric city of Schenectady, keeps in perpetual motion of praise the virtues of the canny islanders. On reception in Japan of news of the signing of the Portsmouth Treaty in 1905 (by Count Komura, one of my former pupils during three years) a cablegram ordering $5,000,000 worth of electric equipment was received by an American company.

AN ILLUMINATING INCIDENT OF THE RUSSO-JAPANESE WAR

During the war with Russia, as an American regular army officer who was

Photograph from Dr. T. A. Jaggar, Jr.

SAKURAJIMA VOLCANO IN ERUPTION, WITH THE CITY OF KAGOSHIMA IN THE FOREGROUND

This remarkable photograph of the greatest volcanic eruption which has occurred in Japan in modern times was sent to the National Geographic Society by Dr. T. A. Jaggar, Jr., Professor of Geology in the Massachusetts Institute of Technology and Director of the Hawaiian Volcano Observatory. Dr. Jaggar is now in Japan, having been directed by the U. S. Secretary of Agriculture to proceed to the stricken country to aid Professor Omori, head of the Japanese Earthquake Commission, in studying the recent disaster. The great Sakurajima eruption occurred in January, 1914. The center of Kagoshima, a city of 70,000 inhabitants, was only four miles from the volcanic crater, but, as by a miracle, no lives were lost during the volcanic discharges.

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LAKE YAMANAKA FROM THE SUMMIT OF FUJIYAMA

This lake lies at an altitude of 3,270 feet, higher than any other lake on Mount Fuji. The Japanese also call it "Three-Days'-Moon Lake," because it is similar in shape to the moon at that phase.

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PICKING TEA ON THE HILLS AND GROWING RICE ON THE PLAINS: JAPAN

The largest tea-growing district in Japan centers about the town of Shizuoka. About one million Japanese are employed in raising tea, and 120,000 acres of land are required. The best leaf is grown around Kyoto, but most of it is consumed in Japan itself. All leaves must be picked by hand, and at the busy season every man, woman, and child goes out to labor. After picking, the tea is dried and fired, and the method of firing determines whether the tea shall be "green" or "black." The white squares in the background are rice fields.

Photograph by C. H. Kragh

ENTRANCE TO THE TEMPLE IN ASAKUSA PARK, TOKYO

. Asakusa is dedicated to Kwannon, Goddess of Mercy, who descended into hell, delivered the condemned, and showered upon them a rain of flowers. This entrance is a sort of façade or pagoda to enhance the importance of the main entrance. Before the earthquake the most popular holiday festival for the lower and middle classes was held near this temple. The long street approaching it was filled with toy shops, tea houses, theaters, and merchants' booths. At wayside stalls tiny rings of perfumed paste could be purchased to burn in honor of the goddess, and also saucers of rice for the sacred pigeons.

Photograph by Kiyoshi Sakamoto

A SHRINE ON THE SEASHORE

The artistic sense of the Japanese is well evidenced, in that the national fête days are festivals of Nature. In the autumn the hours of sleep are changed to daytime, so that the people may be free to enjoy the beauties of moonlight.

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FUJI THROUGH THE PINES

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SUMMER AFTERNOON IN A LOTUS GARDEN

These handsome flowers push up from the ooze and unfold heavily corded green leaves measuring two feet in diameter. The lotus is the sacred emblem of Buddhism, and many of the fountains in the temples are in the shape of this flower. It symbolizes triumph over self; extinction of the fires of passion, abnegation and self-control, and is accepted as a token of all that is best in man and woman.

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KEGON FALLS AT CHUZENJI

The hamlet of Chuzenji lies 10 miles from Nikko, on the shores of Lake Chuzenji, a body of fresh water 15 miles in circumference. The lake belongs to the imperial household, which has stocked it with fish. It is also known as the "Lake of Blessedness," because it was blessed by the Emperor Meiji when he was there in 1876.

a witness told me, some of the Tsar's *mujik* soldiers cut down the telephone and telegraph wires within their own lines to bale their hay and mend their long boots! On the Japanese side, telephones and telegraphs, with trained operators to use them, were as familiar as cartridges.

I believe I imported the first electric machine and the first portable fire-extinguisher into Japan. In 1919, there were 95,877 stations generating electricity, making use of motors of all sorts, with both water and fire as agents. Hundreds of small villages are now lighted at night by electricity, and in them motors of many kinds are used by day.

The use of gas in mills, factories, shops, kitchens, and for varied appliances has developed in like manner, the number of cubic meters of gas generated for service in 1919-20 amounting to 275,-210,682.

In the large cities more than 70 companies operate electric trolley cars, which in 1919-20 carried 1,211,147,504 passengers. For smaller places and for mining, wheeled vehicles are moved by electricity, by steam, and by man power.

FIRST JAPANESE SCHOOL OF TECHNOLOGY ESTABLISHED IN 1871

To those who would penetrate the secret of Japan's rapid development and world-encompassing ambitions, another historical fact is worth noting, especially in comparison with our own national development. Let one scan the meager list of technical schools in the United States in 1871. Except for the Rensselaer Polytechnic of Troy, New York; the Stevens Institute at Hoboken, New Jersey, and the rudimentary state of things at Yale, at Harvard, and at the Massachusetts Institute of Technology, and the infant Cornell University, how feebly developed they were!

In 1871, after a study of Japan's nascent plans for a national system of education, even before there was the Mom Bu Sho, or Department of Education, I had the honor of writing from the interior, at Fukui, and suggesting that a school of technology and of manual training be established in the capital.

The letter reached Tokyo on the very day of decision by the Dai Jo Kan (Supreme Government Council) to create the Department of Education, and I was summoned to Tokyo to establish such a school.

The scheme at first comprised only four professorships—chemistry, physics, engineering, and law (!), with which last astonishing enterprise I had nothing to do. Later, after the return of the embassy from Europe, this first attempt was happily absorbed in a larger foundation, with a dozen professors.

In the twenty or more years of the existence of this institution, under the Department of Communications, there were educated the engineers, architects, chemists, and others who built Japan's steamships, railways, lighthouses, and laboratories, which helped to modernize the face of the country. These gave Japan new tools and weapons, a new suit of armor, and, under all, a new nervous and circulatory system.

With a total of more than 7,000 miles of railway in operation, her resources are still in process of development. Six thousand steamers and nearly 50,000 sailing ships, with a total tonnage of 4,180,305, tell the story. In 1871 my letters and mail matter came to me in the far inland city by runners. In 1923 Japan has nearly 9,000 post offices (in which two-thirds of the employees are women), with 65,000 post boxes. Telegraphs, telephones, and radio stations are commonplaces.

There are special schools of medicine, jurisprudence, commerce and pedagogy in the five national universities, with nearly 500 professorships, the faculties numbering over 1,000 professors and 10,000 students. In addition, there are as many nongovernment universities, which have in total as many pupils and keep up a wholesome rivalry. Of the technical schools — arts and crafts, agriculture, marine industry, etc. — there are more than 250, with more than 80,000 pupils, counting both sexes.

THE ACORN PRODUCES THE STURDY OAK IN 53 YEARS

The acorn of 1870 has become the oak of 1923; but it was planted in a soil made of the enriched mold of a thousand years of culture. The alien of that year, on landing, saw no chimneys, milk wagons,

Photograph from Dr. T. A. Jaggar, Jr.

EARTHQUAKE CRACK IN A DIKE OF MADE LAND ON THE KAGOSHIMA PLAIN

A photographic record of the awesome "yawning" of the earth during the quake which followed the great eruption of the Sakurajima Volcano (see illustration, page 433). Dr. T. A. Jaggar, Jr., the volcanologist and authority on earthquakes, has furnished THE GEOGRAPHIC with a vivid translation of a Japanese account of "The Burning of Sakurajima in the eighth year of Anyei Era" (A. D. 1779), in which the ancient chronicler says: "Ordinary earthquakes feel like a boat rocked by the waves, but these were different—even as a horse, after a scrubbing, shakes his mane. The noises were as of the cry of some mountain birds. The doors and paper screens rattled like hail upon the roof."

water-works, newspapers — few indeed of the externals of what he was wont to consider modern civilization; but culture, fine manners, literature, alert minds, and lovers of the good and the beautiful he found everywhere.

Whatever Japan gains, may she not lose the best of her ancient beauties and inheritances.

In summing up the results of impressions, studies, and experiences of more than two-thirds of a fairly long lifetime, I utter my faith in the Japanese. I have witnessed feudalism, centralization, imperialism, constitutional and party government, with progress in every line of human achievement, yet with the same ebbing and flowing of opinion and policy, as influenced by Europe and America. Having also made myself acquainted to some extent with the invisible forces and inherited ideals of the Japanese, as revealed in their history, literature, and art, I retain my confidence in them.

I cannot but feel that with them rest in great measure the hopes of Asia, and that, next to the United States, Japan can be the chief medium in the union and reconciliation of the Orient and the Occident for the making of a new world.

THE CAUSE OF EARTHQUAKES

By Robert F. Griggs

Leader of the National Geographic Society's Mt. Katmai Expeditions

THE unexampled disaster that has so suddenly overtaken the capital of Nippon inevitably raises the question, Why such calamities? What is the cause of earthquakes? Why are some regions especially subject to them? Can anything be done to predict or alleviate these calamities?

An earthquake is one of the few things in this world whose name accurately and adequately describes it. The earth, being highly elastic, like "a bowlful of jelly," may be set a-tremble by any shock sufficiently violent. Miniature tremors are caused by the passage of every train of cars. The explosion of a powder magazine sets up a somewhat greater disturbance. But nearly all great earthquakes are due to a single cause—the sudden breaking of the rocks under a strain too great for them to bear.

The fracture which sets the earth to vibrating may result in a large displacement of the rocks, and the break may be traceable for many miles. The fracture, or "fault,"* of the Mino and Owari earthquake of October 28, 1891, extended for 70 miles and cut clear across the main island of Japan. In several places the vertical break amounted to 20 feet, and half as much displacement was common. The horizontal movement averaged about six feet.

*"Fault" is a term, derived from mining parlance, applied to a fracture and displacement of the rocks. The appropriateness of the term is not evident until one puts himself in the place of a miner digging along a mineral stratum which abruptly disappears when he reaches a place of shearing in the rocks. From his point of view, the rock is evidently enough "faulty."

CHIEF DAMAGE DUE TO VIBRATIONS, NOT TO SHIFT OF THE GROUND

The damage from earthquakes comes, however, from the vibration rather than the actual shift of the ground. From the displacement on the fault line and the way in which surface objects are tossed about, it is natural to infer that the earth must move considerable distances back and forth during the shock. But this is not correct. Most of the vibrations are only a fraction of an inch in length. It is the suddenness, rather than the amount of motion, that does the damage.

But no one who has experienced the dizzy swaying of *terra firma* during an earthquake, or even examined pictures of earthquake damage, can readily persuade himself that the tremors can be of such small dimensions as the recording instruments prove.

The case is somewhat like that of a marble, which jumps several inches in the air when the floor on which it rests is suddenly struck with a hammer. The

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UNDER THE PURPLE WISTARIAS IN JAPAN

The homes and temple gardens of Japan are famed for their beautiful flowers in season. The plum blossoms of February are followed by the cherry blossoms of April and the wistaria shortly after, the lotus in July, azaleas in midsummer, chrysanthemums in October, camellias in December, and evergreens the year round.

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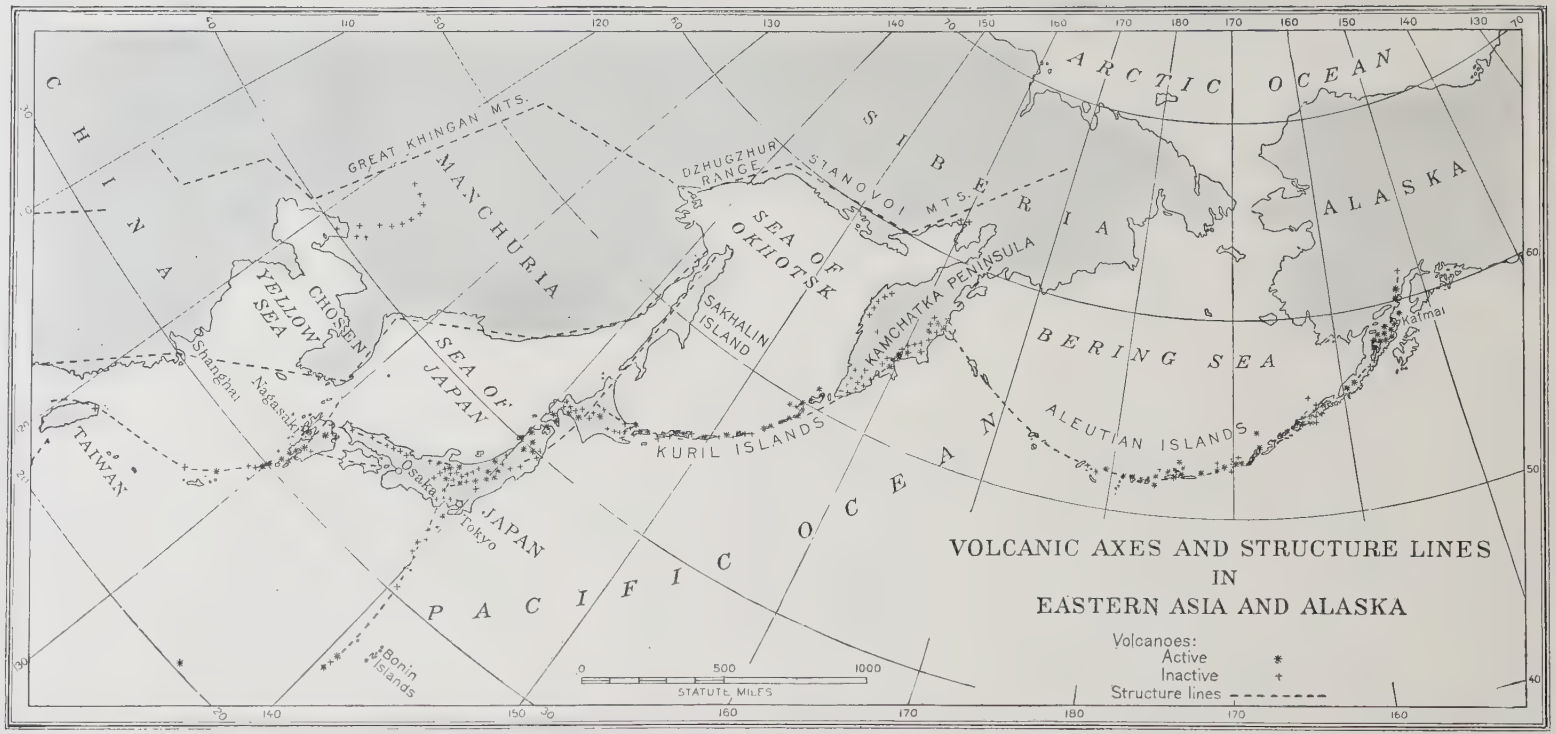
MEDITATION: A STUDY AT NIKKO

Nikko, called by one writer "the climax of Japanese wonders," lies in the midst of the "Mountains of the Sun's Brightness." It is noted not only for its glorious scenery, especially in November, but also for its shrines, its wood-carving and painting. The total number of men employed daily for 12 years in building and decorating the shrines is supposed to have been about 15,000.



Reproduced from the National Geographic Society's Publication, "The Valley of Ten Thousand Smokes"

MAP SHOWING WHY JAPAN IS SUBJECT TO FREQUENT DESTRUCTIVE EARTHQUAKES

Japan is not only the scene of many earthquakes, but the island kingdom is literally "peppered" with active and inactive volcanoes (indicated respectively by stars and crosses). Yet volcanic eruptions and earthquakes are not interdependent. The quakes caused by volcanic disturbance, while sometimes of extreme violence, are seldom if ever widespread. It is significant to note that more than half of all the earthquakes that have occurred in Japan since careful records have been kept have originated in the ocean deep to the east of the islands.

The crust of the earth is much wrinkled and broken, and the folding and faulting (see page 443) accompanying this process are greatest along the boundary lines between elevated and depressed segments, developing cracks. Such folding is seen in the curving mountain ranges of Japan, while offshore is one of the deepest "deeps" in the whole ocean, suggesting that one block of the crust has slipped over the next and pushed it down. Next outside the island festoons of Japan is the scalloped coast line itself. Beyond that is another series, including the remarkable escarpment of eastern Manchuria—the Great Khingan Mountains, the dominating geographic feature of the entire region.

motion of the solid floor is very slight, but the marble, because it is free to move, is propelled a considerable distance.

Similarly, a quick earth tremor of very small dimensions may heave loose rocks or other equally heavy objects many feet from their original positions. The same circumstance explains the very much greater destructiveness of earthquakes on alluvial soil, whose particles are easily broken loose, than on solid rock. The disruption of the earth's surface by the Kansu quake of 1920, which occurred in the loess district of China, where loose, porous soil extends for several hundred feet below the surface, was, perhaps, greater than in any other known earthquake. The affected region was well described by the Chinese as the "land where the mountains walked." *

The fact that both Tokyo and Yokohama were built on loose alluvium undoubtedly greatly increased the destructiveness of the recent terrible cataclysm.

TIDAL WAVES

In many earthquakes the greatest destruction is wrought by tremendous inundations, which sweep over the land like abnormally high tides, rising 10, 20, 30, or even, in exceptional cases, 50 feet above any previous tide-mark.

The terror occasioned by these terrible floods is so overwhelming and they leave so few survivors to tell the tale that accurate accounts of events are seldom to be had.† One of the most lucid descriptions of such a wave is given by Darwin in the "Voyage of the *Beagle*," chapter 14: "The disturbance seems generally, as in the case of Concepcion, to have been of two kinds: first, at the instant of the shock, the water swells high up on the beach with a gentle motion, and then as quietly retreats; secondly, some time afterwards, the whole body of the sea retires from the coast, and then returns in waves of overwhelming force. . . .

"Shortly after the shock, a great wave was seen from the distance of three or four miles, approaching in the middle of the bay with a smooth outline; but along the shore it tore up cottages and trees, as it swept onwards with irresistible force. At the head of the bay it broke in a fearful line of white breakers, which rushed up to a height of 23 vertical feet above the highest spring-tides.

"Their force must have been prodigious; for at the fort a cannon with its carriage, estimated at four tons in weight, was moved 15 feet inwards. A schooner was left in the midst of the ruins, 200 yards from the beach.

"The first wave was followed by two others, which in their retreat carried away a vast wreck of floating objects. In one part of the bay a ship was pitched high and dry on shore, was carried off, again driven on shore, and again carried off. In another part two large vessels anchored near together were whirled about and their cables were thrice wound around each other; though anchored at a depth of 36 feet, they were for some minutes aground.

"The great wave must have traveled slowly, for the inhabitants of Talcahuano had time to run up the hills behind the town; and some sailors pulled out seaward, trusting successfully to their boat riding securely over the swell, if they could reach it before it broke."

Yet by no means all earthquakes along the sea involve tidal waves. In Kingston, Jamaica, the earthquake of January 14, 1907, resulted in the settling of the harbor bottom as much as 27 feet in places, but there was no tidal wave.

The reports of the present Japanese disaster have repeatedly spoken of damage by tidal waves, but at this writing it is not clear how great a share they may have had in the destruction.

EARTHQUAKES NOT CLOSELY CONNECTED WITH ERUPTIONS

It is often supposed that earthquakes are closely related to volcanic eruption, and in the present disaster there have been not a few rumors of the explosion of an unnamed volcano somewhere "in the vicinity."

* See "Where the Mountains Walked," by Upton Close and Elsie McCormick, in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1922.

†A remarkable personal experience on a United States gunboat, which was carried by a tidal wave unharmed two miles inland, is given by Rear Admiral L. G. Billings in his article, "Some Personal Experiences with Earthquakes," in the NATIONAL GEOGRAPHIC MAGAZINE for January, 1915.

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STEAMING ASO-SAN, ONE OF JAPAN'S FIFTY-ONE ACTIVE VOLCANOES

The fissure from which the steams of Aso-san pour lies in the floor of a giant extinct crater in the east-central part of Kyushu, 5,630 feet above sea-level. It belongs to the mountain range known as the "Japanese Alps," in the center of the main island.

This supposition is natural enough, in view of the fact that many earthquake belts are situated near active volcanoes.* But a study of the great earthquakes of history refutes this idea.

The idea of the interdependence of volcanoes and earthquakes was indeed first negatived in Japan itself by the work of Milne, the great pioneer student of earthquakes. As a result of careful studies of the locations of earthquakes, he concluded: "The central portions of Japan, where there is a considerable number of volcanoes, are singularly free from earthquakes. The greater number of disturbances originate along the eastern coast of the empire, and many of these have a submarine origin." †

Concerning this point, Omori recently remarked:‡ "A volcanic district may be assumed to be free from the visitation of a great destructive earthquake whose area is extensive and whose intensity is sufficient to destroy properly constructed wood or iron buildings."

Nevertheless, it is recognized that both volcanic chains and earthquake belts occur in regions where the earth's crust is unstable. They are to be looked on in part as independent manifestations of the same underlying conditions.

Volcanic disturbances indeed often produce earthquakes of extreme violence, though their effects are seldom, if ever, widespread. Such a series of earthquakes culminated on Mauna Loa, in Hawaii, on April 2, 1868. For six days after the beginning they gradually increased in power until the final shock was so violent that neither man nor animals could stand against it. At times, indeed, it was necessary for the prostrate figures to stretch out their arms to avoid being rolled over and over. Almost every sort of man-made structure was demolished in the region of greatest severity. But the area affected was astonishingly small—75 miles away no damage was done.

Contrast with this local quake the recent disaster in Japan, which spread 140 miles up and down the coast and 100 miles inland, though the center of the disturbance is said to have been far off shore. The very restricted effect of volcanic quakes is probably due to the fact that their disturbance is centered at a single point comparatively near the surface of the earth, while a fault line may extend for hundreds of miles and reach to profound depths.

VOLCANIC QUAKES BEGIN GENTLY; FAULTING OCCURS SUDDENLY

Another striking difference between the quakes accompanying a volcanic eruption and those due to a great slip in the rocks should be noted. The volcanic quakes begin with gentle quivers and increase to the climax only gradually, during a period of days or weeks; but in faulting the great destructive shake usually comes without warning, and the later shocks which follow in its train are of reduced violence, as though minor readjustments consequent upon the great slip were being made, until finally quiet returns.

Thus, in the Assam earthquake of 1897, which is considered by many authorities preëminent among modern earthquakes, everything was destroyed in the first 15 seconds and the heavy shocks all occurred within two and a half minutes. To this rule the recent shock was no exception. The after-shocks, as reported by the Imperial Earthquake Observatory, numbered 356 on the first and second days, 289 on the third, 173 on the fourth, 148 on the fifth, and 63 on the sixth day.

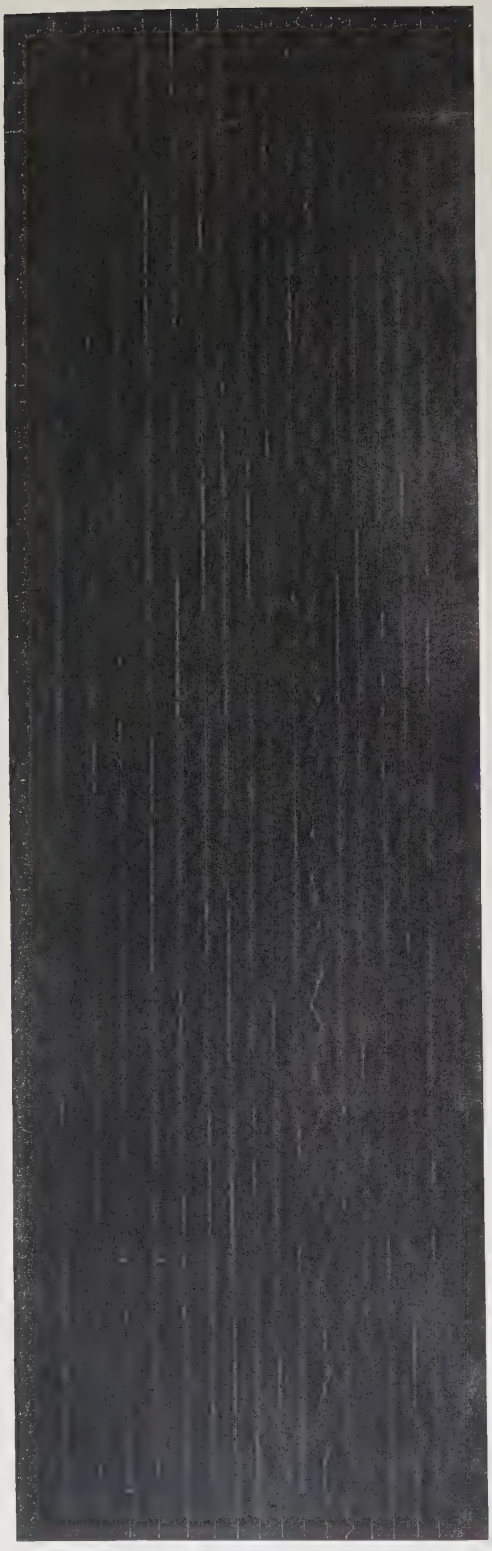
As is well known, the crust of the earth is much wrinkled and broken, as though a stiff rind were adjusting itself to a shrinking interior. The folding and faulting accompanying this process is naturally greatest along the boundary lines between elevated and depressed segments. And this is precisely the position of Japan.

The depression of any segment of the earth's crust is sure to develop surface cracks of two sorts—circular cracks around the center of depression and radial cracks stretching away from it.

* See also, in the NATIONAL GEOGRAPHIC MAGAZINE, "Costa Rica—Vulcan's Smithy," by H. Pittier, June, 1910; "The Shattered Capitals of Central America," by Herbert J. Spinden, September, 1919; "The World's Most Cruel Earthquake" (Messina), by Charles W. Wright, April, 1909, and articles on the Mont Pelée eruption and Martinique disaster in the issues for June, 1902, July, 1902, December, 1902, November, 1903, and August, 1906.

† Seismological Journal of Japan, 1895, p. 16.

‡ Bulletin, Imperial Earthquake Investigation Committee of Japan, volume 11, March, 1923, page 32.



THE SEISMOGRAPH'S "SHORT-HAND" MESSAGE, WRITTEN AT THE GEORGETOWN UNIVERSITY LABORATORY, RECORDING THE DESTRUCTION OF TOKYO AND YOKOHAMA ON SEPTEMBER 1, 1923

The earthquake instrument traces its awesome message by means of a tiny platinum point running over a sheet of smoked paper. This paper runs continuously. The right-angle "jogs" in the lines indicate hours; one of these lines from left to right represents approximately 17 minutes. When no appreciable quake is occurring the platinum point traces a smooth line, hour after hour. When a quake comes the line wavers. When Father Tondorf first examined this record he had to study it at arm's-length lest his breath blow the soot over the thin line; his calculation of the distance of the quake was 6,500 miles. Fifteen minutes later, when the smoke-sensitized sheet had been shellacked and he could study it more minutely, he computed the center of the disturbance as in Japan, 6,300 miles from Washington, which proved to be correct. This estimate was given out in Washington three hours before any direct news of an earthquake in Japan had been received (see text, page 453).

Figures of this sort are familiar to every skater who has observed the cracking of thin rubber ice, as it slowly gives under too heavy a load. If now we imagine the strain to which the ice is subjected, complicated by side pressure toward the depression, we can see that the circular cracks would be bent inward, becoming convex instead of concave on the outside; and if there were a series of pressures against the edge of such a system of cracks, its margin would become a series of scallops.

A glance at the map (see page 446) shows exactly such a series of scallops along the eastern coast of Asia. Beginning at the north, there are: the Aleutians, Kamchatka and the Kuril Islands, Sakhalin and Japan, Chosen and the Lu-Chu Islands, and Formosa (Taiwan). Each of these axes is convex seaward, and there is in many places clear evidence, in the trend of volcanic chains and in the courses of the fault lines, of double systems of tangential and radial fissures like those in the fractured ice.

We can see further, in our imagined system of ice cracks, that inward pressure on the edge of the sinking area would tend to close up the circular cracks and change

them into folds if the crust were flexible enough, or to break them apart and shove the outer over the edges of the inner, either process resulting in shortening the crust and compensating for the lateral pressure.

This is what has happened in eastern Asia. The folding is seen in the curving mountain ranges of Japan, while offshore is one of the deepest "deeps" in the whole ocean, suggesting that one block of the crust—that which carries the Island of Japan—has actually slipped over the next and by its weight pushed it down.

It is significant to note that more than half of all the earthquakes that have occurred in Japan since the beginning of careful records have originated in this deep to the east of the islands. It is as though the two overlapping segments of the crust were sliding on each other under the seaward thrust from the continent.

Just as breaking ice shows a number of circular cracks, one outside the other, so eastern Asia shows several rows of scallops.

In addition to these major fracture lines, there are many lesser ones, incompletely known as yet, but all falling into line with the greater ones. All of these lines, both great and small, are similar in structure and show upon examination that they were produced by the crowding of the continent of Asia toward the Pacific.

JAPAN WAS AMONG FIRST COUNTRIES TO STUDY EARTHQUAKES

So extended a discussion of the structure of eastern Asia may seem far afield from the single earthquake which has visited Tokyo, but this disaster can in no wise be considered an isolated event. It is merely one shock of unusual violence in a region where the ground is never quiet for long at a time. On the average, nearly 1,500 earthquakes every year—four a day—occur in Japan.

Recognizing the inevitable earthquake danger, the Japanese Government early saw the importance of the study of earthquakes, and has long led the world in this branch of science, excelling in the exactness and length of its records of past earthquakes, in the application of the latest discoveries of science to earthquake investigation, and in practical measures to minimize earthquake damage. The Imperial Earthquake Investigation Committee has devised buildings designed to withstand earthquakes. The frame houses recommended have many diagonal timbers, which tie the whole structure together into a single unit, so that it will resist the shock like a ship beaten about by the waves.

An earthquake-proof brick building is more difficult. Most people would feel that a brick building was necessarily a bad earthquake risk, but the Earthquake Investigation Committee has undertaken to prove the contrary. A brick building was constructed in Tokyo which this Committee declared "will stand any shock likely to occur in Tokyo and will serve as a standard with which to compare the effects of a shock on ordinary brick buildings."

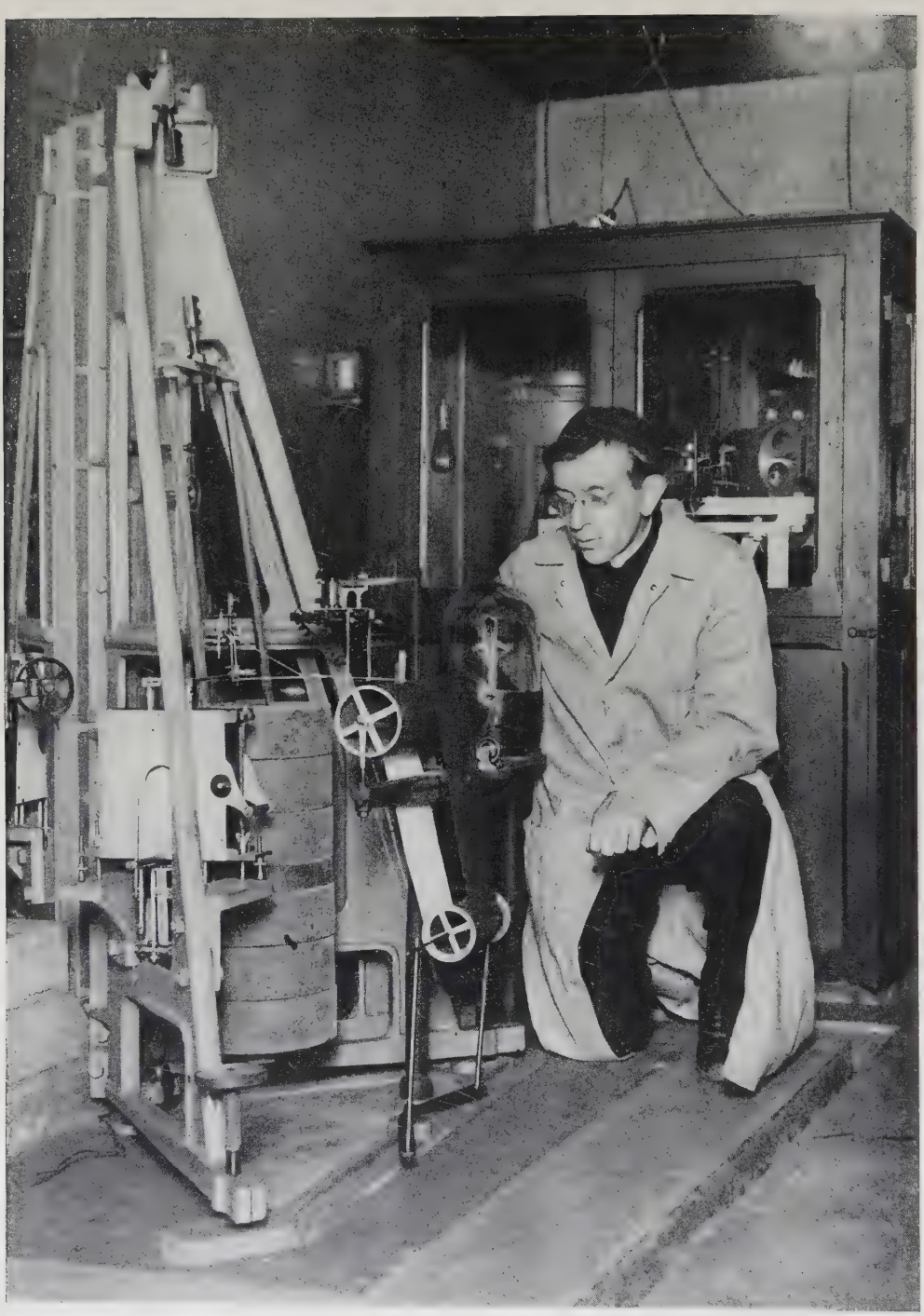
The Committee showed faith in its conclusions, moreover, by housing its seismographs and other instruments in this building. As the press reports immediately following the disaster have given frequent reports from this observatory, it may be inferred that it withstood the shock and justified the Committee's confidence.

The essential principle in its construction was learned from experiments with brick columns on a "shaking table," made to simulate earthquake shocks. Here it was observed that the columns always broke close to the base.

The walls, therefore, were built very thick at the base, tapering upward in a parabolic curve, which investigation had shown to give equal strength throughout the height. The roof, instead of being built into the walls, rested loosely on them, to permit free movement.

It will be interesting and instructive, as detailed reports of the disaster come in, to see how far the recommendations of the Committee were carried out, and how far the precautions suggested went toward reducing the destruction.

We may be sure, however, whatever fuller information may disclose as to the success of the Committee in modifying the buildings of an old city, that when Tokyo is rebuilt these findings will be incorporated in the building code in a way to insure against a repetition of the disaster.



FATHER TONDORF IN THE GEORGETOWN UNIVERSITY SEISMOLOGICAL LABORATORY

In the center of the picture may be seen the band of smoked paper on which the platinum needle inscribes its message of disaster wherever it may occur (see illustration, page 450). Theoretically, the platinum point is so balanced and counterbalanced as always to remain stationary; the smoked ribbon sways with the earth, which is elastic and transmits every quake, however distant.

HOW THE EARTH TELEGRAPHED ITS TOKYO QUAKE TO WASHINGTON

By the Rev. Francis A. Tondorf, S. J.

Director Seismological Laboratory, Georgetown University

THAT wisdom ripens white with the early hours and may be had for the gleaning only, is an aphorism which has ever been a favorite saying of parent to child. Æschylus, Greek poet, had sung some two thousand years ago that "it is never too late for the old man to learn his lesson"; and so with my early visit, on the morning of the first of September, to the cave which houses the seismographs of the Georgetown University Seismological Station, I was made wise, among the first, if not the first, in the United States, that the proverbial earth-spider of the Japanese had reared his back against the mighty columns that brace the floor of the Isle of Japan, thus-wise rocking its superstructures to their very foundation stones.

On removing the sheets from the sensitive detectors, known as seismographs, and suitably mounting them, these were ready for closer inspection. The ground-scripts of Mother Earth bespoke, apart from any measurement, one long, weird message of possible destruction on land or sea afar off.

Certain it now was that the inscribed quake was not of volcanic origin, for these are rarely severe, never widefelt, and always beyond the reach of the distant telltale. So the conclusion was warranted that a displacement had taken place in the cupola of the globe, and this necessarily in an area abutting some seam of weakness.

Fortunately, the seismogram was strikingly distinct, and so the estimate of the distance a matter of a minute's calculation. Strangely enough, Mother Earth has an efficient corps of heralds, ready at a second's notice to dispatch her messages of disaster to every corner of the globe. Onward they wing their way under the disguise of elastic waves, one with a velocity of 800 kilometers (497 miles), the other with 450 kilometers (279½ miles) per minute. The time-lag, when measurable at their destination, forms the basis of computation.

Whoever could solve the problem of the distance between Washington and New York, given the time of arrival of two trains that had left Washington simultaneously and traveled with different speeds along parallel tracks, would rob seismology of much mystery.

LOCATING THE EARTHQUAKE IN JAPAN

The first alarm was sounded in Washington at twelve minutes after 10 o'clock p. m., eastern standard time, and the second approximately eleven minutes after, the distance accordingly totaling to 6,300 miles. Such was the estimate furnished to the Associated Press and sent out over its wires three hours before any word of disaster had reached Washington.

Take a reliable map, apply this distance, and you will be convinced that the seismograph has something to do and does it.

Mark Twain it was, I think, who said that he found it easy to see how the astronomer could figure the distances of the stars, but that he could not see how they read their names with the telescopes.

Maybe the wonder grows how the seismologist can spell the location from the queer etchings of the white on black of the seismogram. Nor can he, at least not scientifically, if the gram of a single observatory is all that is to hand.

The old herb doctor learned the proper treatment of disease by trying out plant juices on the other fellow. Elimination has taught the wisest of Solomons a great deal. Then, is it a crime for the seismographer, when science fails him, to turn his back on a recreant teacher and try elimination? That is not guessing.

How do we do it?

With the seismographic station as a center, we draw a ring with a radius equal to the computed distance and we have lopped off a mighty big portion of the 196,940,400 square miles of the earth's surface where the quake did *not* happen. That's something.

Then we keep to the one-rail trolley, noting the stations along the route with

a seismological guidebook within seeing, read off the seismic zones, and if we find only one, why we've got it.

And so we learned of the quake in Japan.

Had we any prejudices against this method of elimination, we might have very readily suppressed them in the present instance, for Dr. F. Omori, member of the Imperial Earthquake Investigation Committee and director of the Tokyo Seismic Observatory, the foremost authority to-day in earthquake researches, predicted in 1921 that within six years of that date there would occur a cataclysm. This faithful old Achates had kept a watchful eye "every day and in every way" on those tiny earth rockings which had kept the Mongolian nurse, sentry over the infant cradle, from striking for shorter hours and higher wages.

Omori noticed—I quote his own words—that for an earthquake district like Tokyo and the neighboring provinces, the frequent occurrences of *ordinary* small earthquakes may be regarded as maintaining the portion of the earth's crust concerned in a state of normalcy, removing so often the underground weak points, thereby preventing the production of a strong earthquake. On the other hand, a low seismic frequency must cause an accumulation of telluric stress, and consequently is likely to be followed by a seismic disturbance of a large magnitude.

Catastrophes on June 20, 1894, October 15, 1884, and March 31, 1909, had closely followed in the wake of such frequency minima. Then, with voice prophetic, he warns that, as during the last nineteen years the frequency variation indicated a period of six years, we may expect the repetition of a disturbance similar to that of the recent earthquake in some six years, and another at the end of a further interval of some six years.

The Japanese have had no monopoly on such forecasts. Californians had them from resident geologists some days preceding the San Francisco quake. Both communities seemed to have failed to profit by them. Confidence in the seismologist has not yet reached its optimum. It will, *errando discimus*. With an average occurrence of an earth shock every two hours and twenty-seven minutes, the chances of error are not few.

"Children should be seen, not heard," is an interdict dating back to Cain and Abel. Seismologists, alias Benjamins in science, apparently fall under the ban. Realizing this, you find them timidly advancing their theories with a "perhaps," "not unlikely," "possibly," etc.

SEISMOLOGY, ONE OF THE YOUNGEST OF SCIENCES, PRESENTS ITS "PERHAPS"

With apologies to the Nestors in science and with the footnote that the Planets are far too big to be narrowed down into the small margin of the brain, the following summary of data regarding the recent catastrophe is suggested as possible:

The quake was undoubtedly due to a slipping in the earth's crust following an abnormal underground stress accumulation.

The origin was some distance from Tokyo.

Seismic activity in Tokyo Bay, as a compensation to the less recent activity in the mountainous districts, was at least a contributing cause.

That "a great break in the ocean's bottom" was the cause of the quake, as expressed by an American geologist in an interview with a news agency, is questionable; for since the destructive quake of 1854 the ocean's bed has been remarkably quiet and some years will intervene before such activity may be resumed. Even under those conditions, Omori is of the mind that Tokyo will not suffer, but that the disturbance will be experienced farther westward.

Precipitations and barometric variation may be taken as possible secondary causes.

The geophysical conditions on which Omori predicted severe quakes would occur in 1927 and 1933 have been so altered by the recent disaster that these prophecies no longer apply.

Finally, for the consolation of Tokyonians, it may be recalled that never in the history of earthquakes has any one locality suffered a second overwhelming catastrophe within a generation, and the Japanese capital is not likely to be visited by another cataclysm within the lifetime of any of the present survivors.

Time *may* tell us the true story.

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THE STORY OF THE HORSE

The Development of Man's Companion in War Camp, on Farm, in the Marts of Trade, and in the Field of Sports

By Major General William Harding Carter, U. S. A.

Author of "Horses, Saddles and Bridles," "Life of Lieutenant General Chaffee," "The History of the Sixth Cavalry," "The American Army," etc.

Paintings by Edward Herbert Miner

CASUAL observation of American cities, with streets overcrowded with motor vehicles, tends to create the impression that this is a horseless age, and that under existing conditions that useful animal is doomed to disappear.

Statistics, based upon the census, show, however, that while the normal rate of increase has not been maintained, there are nearly 300,000 more horses in the country than there were 20 years ago, and that the number of mules has increased by 2,370,000 during the same period, notwithstanding the fact that during the World War, between 1915 and 1918, there were shipped abroad more than 950,000 horses and 345,000 mules.

These facts would seem to indicate that the doom of the horse has not yet been sealed, and that he will continue to abide with us, not only because he is useful, but because from time immemorial he has earned and held the affection of mankind.

If the literature of a subject is an indication of public interest, then the horse truly ranks high, for it has been estimated that more than 2,000 books relating to this animal have been published in England and an equal number elsewhere. No special effort has been made by the Library of Congress to collect books on the horse, for the reason that other government agencies specialize on that subject; yet there are deposited in the Library nearly 1,000 volumes devoted exclusively to the horse, while the number containing references to it is countless.

THE MILITARY HERO AND HIS HORSE ARE INSEPARABLE IN SCULPTURE

History would lose much of its charm if the deeds of the horsemen of all ages were eliminated. Coming down the centuries, the history of which has been embellished with the recital of the deeds of ancient warriors, crusaders, and knights errant, we find General Allenby, with his clouds of horsemen, in the World War, fighting on the same fields as of old, and using the Bible for military information in the theaters of operations as well as for spiritual guidance.

The deeds of great warriors have ever been perpetuated in marble or bronze, and in the course of time doubtless Allenby will be duly honored. It is inconceivable that a great military leader should be

Photograph of H. E. Talbott, Jr.

A CENTAUR OF THE POLO FIELD

Both America and Great Britain encourage polo, football, and other sports among their armed services, being mindful of Wellington's aphorism, that the battle of Waterloo was won on the cricket fields of Eton.

© National Photo Co.

PRESIDENT COOLIDGE ON "GENERAL," A STANDARD-BRED MOUNT

Until the advent of President Coolidge, the White House had not had an enthusiastic equestrian since the days of Roosevelt. President Taft, President Wilson, and President Harding all preferred the motor car to the horse for recreational rides.

Photograph by W. E. Corbin

HOW THE HORSE HAS GROWN IN THE LAST SIX MILLION YEARS

Amherst College science laboratory, Amherst, Mass., houses one of the most interesting exhibits in the world, showing the development of the horse through the various geologic ages, the last to complete the series having been added during 1920, from the Bad Lands of South Dakota. The tiny Eohippus, only 11 inches high, has four toes on his front feet and three and a fraction of a fourth on his hind feet. The second horse has three toes, all touching the ground when he walked, and is about as large as a Collie dog. Number 3 has toes, but the side ones do not touch the ground; the fourth has lost his side toes during the process of development and has only a "splint" remaining to represent the instep portion of the toes. The fifth and largest skeleton is that of the horse of to-day.

sculptured otherwise than upon his favorite charger. To do differently would break the spell of a thousand years.

In modern war, generals are enabled to command armies of incredible size by utilizing automobiles, telephones, and telegraph wires; but when it comes to actual leadership of units in open warfare, the commander must have his horse at hand.

When some future Congress shall decree that a statue of General Pershing, the only American who ever commanded a million men in battle, shall be erected in the Capital of the Nation, it is impossible that a sculptor should think of representing him seated at a telephone or in an automobile.

FAMOUS HORSES OF GREAT GENERALS

The celebrity that has attended the horses of all ages which have carried successful generals in battle has led to their selection as models by artists and sculptors, but unhappily monuments are rarely erected until long after the generals and their horses have passed to the Great Beyond.

Many horses of military leaders, such as Bucephalus, the charger of Alexander the Great; Marengo, the famous horse of Napoleon, and Copenhagen, the favorite mount of the Duke of Wellington, are well known to history.

America is not lacking in historic horses. Every schoolboy is familiar with the picture of General Israel Putnam, on his favorite horse, galloping madly down a long flight of steps to escape the British dragoons, who had closed all other avenues of escape. The picture of Washington on his handsome charger, Nelson, receiving the surrender of Cornwallis' army at Yorktown, has brought the glow of pride to generations of Americans. Three-quarters of a century ago it was wholly improbable that any discussion of the campaigns in Mexico could take place without some mention of General Zachary Taylor's well-known horse, Old Whitey.

The Civil War was replete with interest in the favorite horses of the great commanders.

General Ulysses Grant's military career was wholly devoid of theatrical display, but he was generally recognized as a fine horseman, and the men of the western armies always manifested interest when he rode among them.

GRANT'S LETTER CONCERNING HIS HORSE JACK

The writer recently had the good fortune to find a book on the horses of the Sahara, which had belonged to General Grant, and discovered, pasted in it, a copy of a letter written by him to the wife of General Sherman, who was assisting at a fair to raise funds for the sick and disabled soldiers discharged at the close of the Civil War. It was publicly announced that the purchaser of the famous horse mentioned in General Grant's letter should also become the owner of the autograph letter, which was as follows:

"WASHINGTON, D. C., May 31, 1865.

"MRS. ELLEN E. SHERMAN.

"DEAR MADAM:

"As a slight testimonial of the interest I feel in the great Northwestern Fair, now being held in Chicago, for the benefit of sick and disabled soldiers, who have endured so much for the maintenance of our government, permit me, through your agency, to present to this loyal and charitable enterprise the horse 'Jack,' well known in the western armies. I left Illinois on him in July, 1861, when commanding the Twenty-first Regiment of volunteer infantry, of that State. I rode this horse more than all others put together, from the time of leaving Springfield, on the 3d of July, 1861, until called east in March, 1864.

"On my promotion to the command of the armies of the United States, I left 'Jack' in the West, latterly with J. R. Jones, United States Marshal for the Northern District of Illinois, residence Chicago. Mr. Jones has been directed to deliver the horse to your order.

"If I was not deceived in the purchase of 'Jack,' he is now eleven years old. He is a very fine saddle horse, very gentle in harness, but requires whip and spur.

"Hoping that the fair will realize the full expectations of loyal people, and do credit to the great and growing Northwest, where it is being held,

"I remain, very truly, your obedient servant,

"U. S. GRANT,
"Lieutenant-General."

When, after four years of grueling war, the curtain fell on the Lost Cause, and General Robert E. Lee slowly guided his splendid war horse Traveler from the fateful field of Appomattox, there was graven a picture in the heart of every red-blooded soldier, no matter under which flag he had fought.

THE EPISODE OF TWO BROTHERS WHO RODE AWAY TO FIGHT

Virginians were ever horsemen, and when the fratricidal war began, two brothers rode forth grimly to fight for the right as each saw it. The one, General William R. Terrill, a graduate of West Point, who declined to follow his State in secession, was killed while leading his Federal brigade at the battle of Perryville, Kentucky; his brother, General James B. Terrill, was killed while leading his Confederate brigade at the battle of Bethesda Church, Virginia. When the Civil War had closed, the heart-broken father brought the bodies of his two sons to their old Virginia home and buried them in the same grave. The story of how brave men rode to their deaths for principle, as each one viewed it, is briefly told in the inscription on the stone placed to mark the grave:

"This monument erected by their father. God alone knows which was right."

The poet, T. Buchanan Read, immortalized in verse the splendid war horse of General Philip Sheridan, which carried him into the battle of Cedar Creek from Winchester, twenty miles away. When this famous horse died his skin was mounted and is still preserved. While not so imperishable as bronze or marble, the mind may conceive a more correct impression of General Sheridan on horseback than is possible from an examination of his representation in bronze.

WILD HORSES DISAPPEARED FROM AMERICA BEFORE COLUMBUS ARRIVED

The history of the horse and the gradual development of the types now known have long been subjects of painstaking study by trained investigators, and some of their researches may be profitably reviewed.

With centuries of confusion among those that have passed since the dawn of history, it is not strange that some threads of information should be missing, but rather that so much has been preserved concerning the horse.

BAS-RELIEF OF KING ASSURBANIPAL HUNTING THE LION: AN ANCIENT ASSYRIAN SCULPTOR'S CONCEPTION OF THE HORSE AT THE GALLOP (SEE TEXT, PAGE 563)

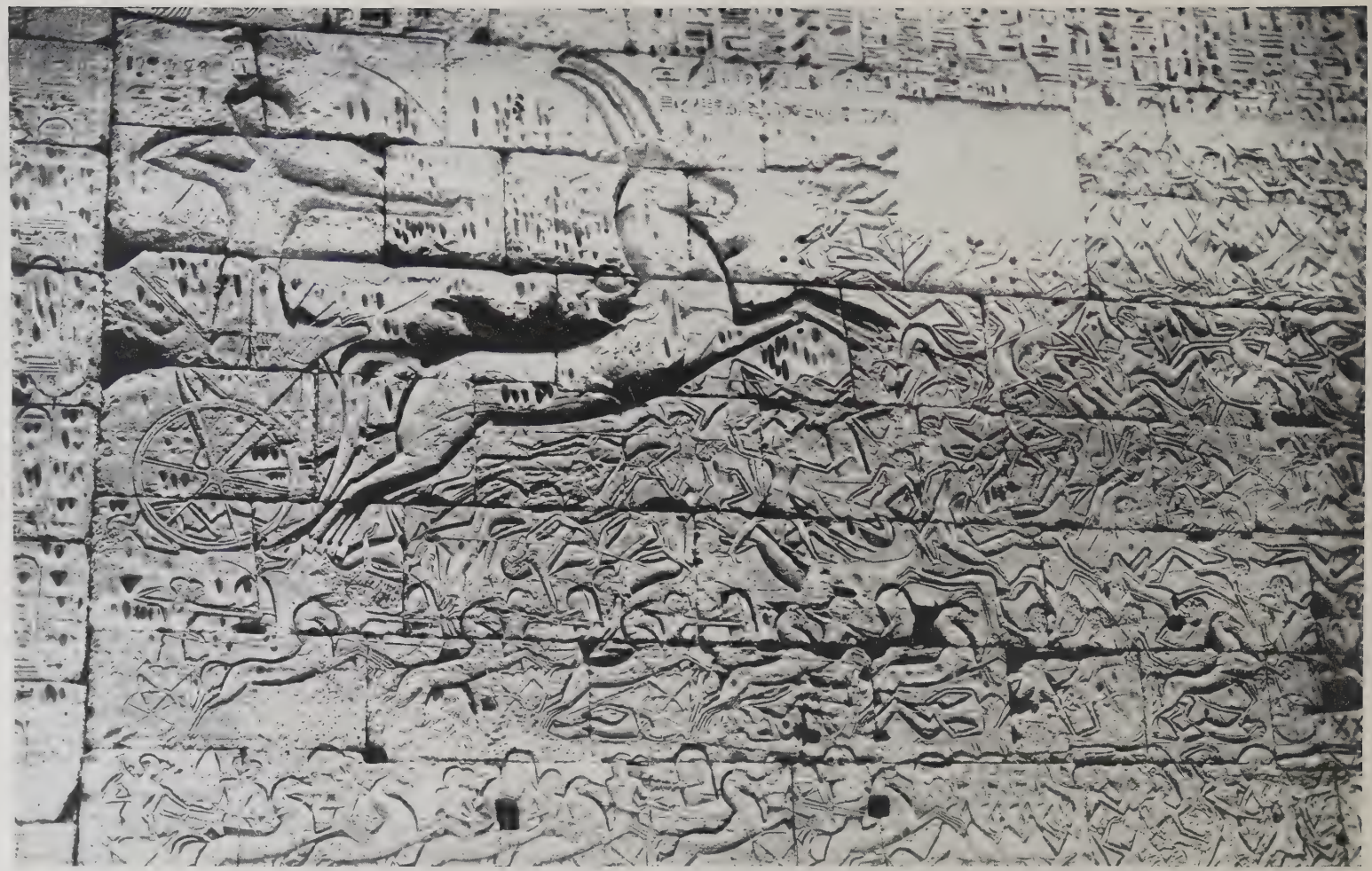
The horse has been the companion and servant of man in nearly all his migrations and conquests, and has always played an important part in the development of that civilization which is based upon intelligent cultivation of the soil.

Scientists all agree that in prehistoric ages certain types of horses ranged over parts of Asia and of North and South America, and that while the wild horses of Asia appear to have descended from the original stock, all such animals had disappeared from North and South America before any modern Europeans landed here.

Research efforts have been highly successful in establishing in the minds of scientists the multiple-toed skeleton remains of an ancient animal as the progenitor of the horse, which during all recorded history has been distinguished by a single toe encased in a wall of horn or hoof, the form best adapted to carrying heavy weight at speed over rough ground.

SOME UNSOLVED MYSTERIES OF THE HORSE'S ANATOMY

There are certain apparently useless structures connected with the legs of the horse which have given rise to many of the theories concerning his probable evolution from an animal of different type. There is on the inner surface of each fore leg of the



Photograph by A. Gaddis and G. Seif

WAR SCENE ON THE WALLS OF THE MEDINET HABU TEMPLE OF RAMESES III: THEBES

These drawings display a degree of spirit which is surpassed in Egyptian sculpture only by those on the temples of this ruler's great namesake and predecessor, Rameses II. Pharaoh is here represented as standing in his car, drawn by his horses at full speed, while he discharges his arrow at the retreating enemy.

Photograph by A. Gaddis and G. Seif

SUCH WERE THE CHARIOTS WHICH FOLLOWED THE ISRAELITES FLEEING FROM EGYPT 3,400 YEARS AGO

This is the vehicle of Menne, the Egyptian land steward and estate inspector under the Eighteenth Dynasty, as it is depicted on the walls of his tomb at Thebes. The breeding of horses was considered of the greatest importance among the ancient Egyptians and they proved of great utility, but they did not enjoy sacred honors, as so many other animals did. Many of them were exported to neighboring countries, and Solomon bought them, at a hundred and fifty shekels of silver, from Egyptian merchants who traded across the Syrian desert.

horse, above the knee, and on the inner surface of each hind leg, below the hock joint, a callous, elongated piece of skin known as "chestnut," which has long been a subject of investigation, based upon the idea that it represents the former existence of an appendage which has disappeared in the process of evolution (see chart, page 476).

There is also a bony, wartlike structure, at the back of the fetlock or pastern joint, quite pronounced in some animals, which serves no useful purpose to the horse in his present form.

Practically all writers on the history of the horse who have given serious study to the subject incline to the belief that the wild horse of the steppes of Asia has the most legitimate claim as the source from which the domesticated horse was derived. Not all, however, accept this contention, for some cannot reconcile the appearance and conformation of the present wild horse of Asia with the many types of horses with which the world has become more or less familiar (see text, page 478 and Color Plate I).

Especially do the admirers of the Arabian horse decline to accept this theory, and in the absence of any known history of the last-named breed in Arabia or India, which connects it with other horses of that region before the Christian Era, there may be basis for the contention, and the Arabian may have had his origin in Africa, the home of the Barb horse and numerous branches of the solid-hoof animal of the ass, zebra, and quagga groups (see text, pages 480, 481, 485, 493, and 496).

The Barb horse differs less from the Arabian than the latter does from all other horses. That the conformation, size, and character, generally, of any type

EQUESTRIAN FIGURES IN THE FRIEZE OF THE PARTHENON

The renowned frieze on the outer walls of the Parthenon was a flat bas-relief 525 feet long. It represented the Panathenian festive procession. The horses of this period bore a striking resemblance to the wild horse of Asia (see text, page 464).

of horse may be modified in the course of time, by subjecting him to changes of climate, temperature, forage, and soil, is too well known to admit of question; but the Arabian has only five lumbar vertebræ, while, with rare exceptions, there are six in other horses.

That is a difference which would not be accounted for by reason of change of environment, climate, or forage; and this lends encouragement to those who contend for the Arabian horse as an original stock.

In tracing the history of any particular type of horse, it has been observed that the claim is usually presented that this or that breed is the progeny of native stock or of a cross on native stock.

It seems incredible that the heavy, medium, and light classes of horses exhibited at all of the great horse fairs should have descended from a common ancestry, for they differ quite as radically as the deer, the caribou, the elk, and the moose, all animals of the split-hoof breeds, concerning which there is no theory of descent from a common stock.

EARLY HISTORY OF THE HORSE

From earliest times the horse has been known to exist on the high table-lands of Asia.

The use of horse chariots prevailed in Egypt as far back as the history of that country has been made known through monuments and ancient inscriptions (see page 462).

Among the bas-reliefs and pictures of Assyrian, Persian, Nubian, Greek, Roman, Byzantine, and other horses of the ancients, the types are limited and bear but slight resemblance to the modern breeds of horses as developed within the past two centuries (see pages 460 and 461).

© Roland W. Reed

A PIEGAN AND HIS PONY IN THE MONTANA HILLS

The Spaniards found no horses in the New World. The Indians, at first, regarded the strange imported animals with wonder and terror.

The horse, as depicted in the fifth century B. C., in the frieze of the Parthenon and numerous bas-reliefs of that period, bears much resemblance to the wild horse of Asia in size, the shape of the head and neck, and the peculiar short, upstanding mane. The size is readily estimated in comparison with that of the riders, whose legs hang down far below the bodies of the horses (see page 463).

From this early period the horse, as pictured in the geographical areas now occupied by modern nations, began to show an increase in size and weight, and gradually assumed some of the conformations by which we now classify the several breeds of modern horses.

It is a remarkable fact that all history, ancient and modern, is more a recital of wars and conquests than of industrial and commercial progress, and therefore it is not surprising that the war horse is depicted, almost to the exclusion of any other, in the writings, pictures, and sculptures of the ancients.

The writings of Xenophon comprise very complete dissertations upon horsemanship and the duties of cavalry during the fourth century B. C., and many of the points of the horse regarded as desirable then are in entire accord with the requirements of army inspectors of remounts for cavalry service to-day. The Macedonians had long been accredited as

TAPESTRY ARTISTS' CONCEPTION OF HORSES AND HORSEMANSHIP IN THE LOUIS XIV PERIOD

In a series of designs depicting "Twelve Months of the Year," this panel represents July, the Sign of the Lion in the Zodiac. The party is going hawking, and the lady seated on a white horse holds a falcon on her hand.

horsemen when Alexander the Great reorganized his army and established the cavalry as a separate unit.

It is historically true that no commander of mounted troops has ever been satisfied with any but good horses, for the lives of his men have depended upon having mounts superior to those of the enemy.

Reasoning from analogy, it is certain that efforts to improve the native breeds of horses began when nations first made war upon each other, and have continued through the intervening centuries to the present time.

HUMAN INTEREST NEVER FAILS THE WINNER

During periods of peace, and with increasing populations, the needs of the agriculturists for farm animals began to take form, and the improvement of draft animals proceeded with that of war horses, and gradually has come to be by far the more important.

In all recorded history trials of strength

Photograph by Nancy Ford Cones

THE FAVORITE

The horse has been the companion and servant of man in nearly all his migrations and conquests, and has always played an important part in the development of the civilization which is based upon intelligent cultivation of the soil (see text, p. 460).

and speed have tempted men to train both themselves and their horses to enter the competitions which in ancient times played a great part in the affairs of state and nation. From the earliest times, when chariot races were provided with settings to tempt the charioteers to deeds of daring, through the romantic period when knighthood was in flower, down to the present, when Man-of-War was acclaimed the greatest of race horses, human interest has never failed the winner.

In the representations of the horse by sculptors, artists, and tapestry-weavers of old, there is observed the same tendency that has continued through the ages in the selection of models. One never sees the undernourished, rawboned, neglected animal, but the well-developed, sleek, and carefully selected horse to represent his class (see illustrations, pages 463, 467, and 534). And this was altogether the proper course, for everything which tends to establish correct ideas as to perfection of quality gives incentive to improvement and especially tends to encourage breeders of horses.

IMPROVEMENT OF THE HORSE

The development of the horse has followed many lines, each indicating a purposeful end in view. The horse that is destined to seek its food on the open range, without shelter from the storms of winter and the midday rays of the sun in summer, accommodates itself to the conditions of its environment; the weak perish and the hardy survive.

In this preparation to withstand hardships on short for-

Photograph by Donald McLeish

THE FAMOUS BRONZE HORSES OF LYSIPPUS ONCE MORE IN POSITION ABOVE THE MAIN PORTAL OF ST. MARK'S CATHEDRAL, VENICE

They once adorned the triumphal arch of Nero at Rome, after which they were taken to Constantinople, where they adorned the imperial hippodrome until the Doge Dandolo brought them to Venice in 1204 as the spoils of war. In 1797 they were carried to Paris by Napoleon, and were finally restored to St. Mark's in 1815. They were removed to a place of safety during the World War to avoid the danger of airplane raids.

age, the first and most observable tendency is a limitation on growth, which gradually accommodates itself to the possibility of eking out an existence during the periods of greatest privation.

Transferred from such environment to the land of plenty, the first observable change is increase of size. With abundance of nourishing food and protection from inclement weather, the horse of any breed will quickly respond, and in a few generations, by careful selection, will bear little resemblance to its early progenitors (see text, pages 488 and 489).

HORSES FIRST USED FOR WAR CHARIOTS

Just when nations began to develop the heavy or draft breeds of horses has not been definitely determined. It has been accepted apparently by historians

MEISSONIER'S MASTERPIECE, "THE CAMPAIGN OF FRANCE," OR "1814," SHOWING NAPOLEON ON HIS WHITE CHARGER ACCOMPANIED BY HIS MARSHALS

The artist depicts the Emperor of the French in 1814, after the Battle of Laon. The sky is dreary, the landscape devastated. The dejected faces express despair. In the center of the picture, seated on his white charger and wearing his famous gray coat, rides Napoleon. Close behind follow his marshals—Ney, with his overcoat buttoned around his shoulders; beside him Berthier; then Flahaut; farther back are Drouet and Gourgaud, and beside them an officer who from sheer fatigue has fallen asleep on his horse.

Photograph from Taber Prang Art Company

CHECA'S CONCEPTION OF "BEN HUR'S CHARIOT RACE"

One of the most famous horse races of fiction is that described in General Lew Wallace's best-known novel: "Ben Hur was seen to lean forward over his Arabs and give them the reins. . . . Out flew the many-folded lash in his hand, and over the backs of the startled steeds it writhed and hissed. . . . They responded with a leap that landed them alongside the Roman's car. . . . A crash was heard loud enough to send a thrill through the circus. . . . Down on its right side toppled the bed of the chariot of Messala."

Photograph by Paul Thompson

A GIRL JOCKEY WEIGHS IN

American jockeys have developed a method of riding, dubbed the "monkey-on-the-stick" style, which requires a sort of acrobatic horsemanship. The short stirrups, with a seat which throws the weight forward of the withers, relieves the hind legs—the propelling power—and enables the horse to make a fraction more speed than the former, long-stirrup seat.

that the horse was first used in low, two-wheeled chariots, of narrow track, mainly for war purposes, and that the general use of the animal for riding followed, as nations began to carry on distant forays and wars.

It is highly probable that vehicles of construction similar to the war chariots were used for transportation purposes, for ancient armies could not make war without supplies, any more than can those of to-day, and all men with military experience are cognizant of the prominent part played by the wagon and pack trains, once an army has moved from its base of supplies.

It is a notable fact that the countries in which Cæsar campaigned in western Europe, including also England, eventually became the region of greatest development of all the heavy types of horses. Doubtless the good roads which so definitely marked the long occupancy of the Romans were the greatest justification to breeders in their efforts to produce a heavy horse, capable of pulling large loads over dependable roadbeds.

Photograph by Underwood & Underwood

ONE OF FIFTY-ONE THOROUGHBREDS, VALUED AT $1,000,000, ARRIVING IN NEW YORK

The carefully crated animal is being raised from the hold of the ship after his voyage from France.

BRITAIN, BELGIUM, AND FRANCE HAVE DEVELOPED FINEST DRAFT HORSES

Nowhere else in the world have draft animals been developed comparable in the slightest degree to the French Percherons, the British Shires and Clydesdales, and the Belgians. Breeders the world over turn to them when seeking to improve their heavy breeds of horses (see text and illustrations, pages 504-512).

Nearly every country has some particular breed of horse on which the nation's pride is concentrated, even though it be an undersized horse or pony. There are always legends as to feats of endurance, speed, or exhibitions of superior intelligence, to keep alive the sentiment of a community in which horse-breeding plays an important rôle.

This sort of pride finds no counterpart in the products of industrialism, where the individual becomes an insignificant part of the grinding mill wheels or is lost

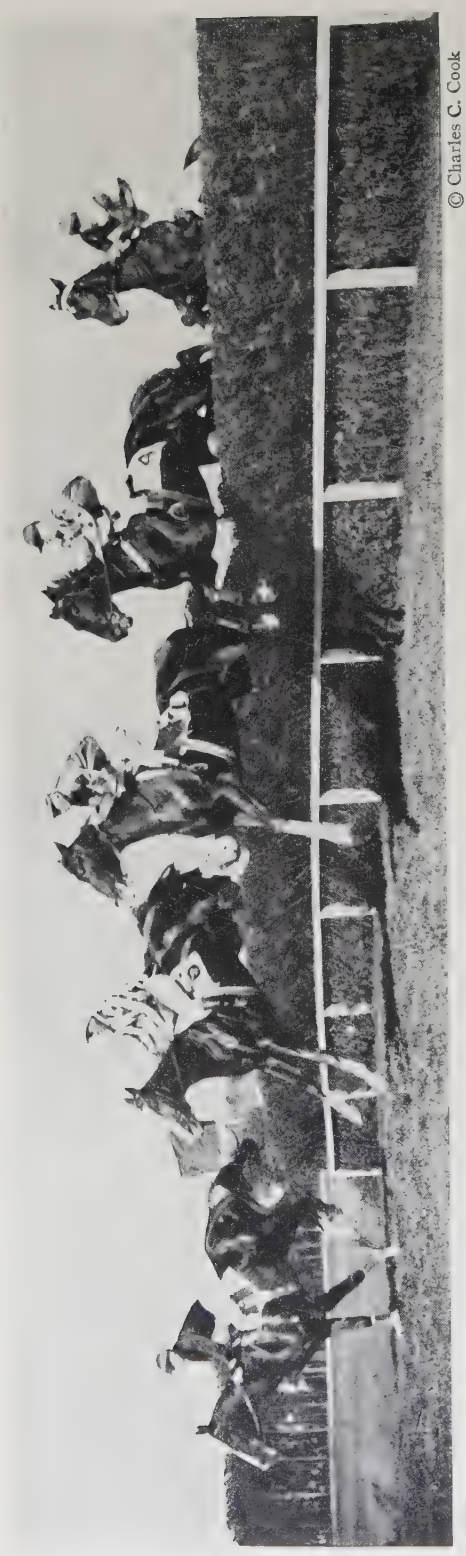
© Wide World Photograph

AN ACROBATIC HORSE AT A LONDON FAIR: HE HAS ASSUMED THE POSTURE OF A BOXING KANGAROO

Sketch by Edward Herbert Miner

THE TROTTER, THE PACER, AND THE RUNNER IN ACTION

This sketch shows the three gaits which horses assume when traveling at speed, in the relative positions which the speed of the different gaits would place them. The trotter (left) strikes, at the completion of each stride, on the forefoot of one side and the hind foot of the opposite side; thus always the legs of the same side move in opposite directions, the forefoot being raised before the hind foot of the same side passes over to its landing position. The pacer (center) moves the two legs of the same side together in perfect rhythm, both when leaving the ground and when landing; this gait is clearer from interference than the trot and is a little faster. The runner (right) differs entirely from the other two, in that at the end of each stride he lands on one hind foot. After the impetus of the next stride has been given by the hind quarters, the weight is placed entirely upon one foreleg before the animal leaves the ground. It is this peculiarity of stride of the runner that places so much more strain upon the Thoroughbred race horse than is borne either by the trotter or the pacer. Both the latter, with only a light harness upon them, bring their weight down upon two feet, whereas the weight of the runner and of its mount is thrown entirely upon one.



© Charles C. Cook

A REMARKABLE PHOTOGRAPHIC STUDY: EVERY POSITION OF A HORSE TAKING A JUMP, AT BELMONT PARK, NEW YORK

in the everlasting process of setting a continuous array of rivets.

From the Mongolian ranges, coming westward, the Turkoman, Persian, the Karadagh of the Cossack, the Kurdish, the Arabian, and many other breeds have won the hearts of the peoples whom they have served in war and peace for untold generations; and this brings us to the confines of modern Europe, where are now centered all the breeds upon which we have drawn to create the great aggregation of horses found at the present time in America.

BRITISH HORSES

When Cæsar invaded the British Isles, about the middle of the first century B. C., he found the natives possessed of hardy horses, of small size, which they used with considerable skill. There was no pretense of raising forage for horses in that early period, and they ranged in droves, being rounded up from time to time to select those for use and possibly for breeding.

These animals constituted the foundation stock of the British Isles, on which was grafted from time to time superior animals. Those left to seek forage on the range remained small and undeveloped and comprise in their descendants the ponies known under various local names.

The foundation stock of British horses from which our early immigrants made their first importations has been much investigated, because from it was developed the Thoroughbred, which, once established, whenever crossed with good mares, has resulted in definite improvement along the lines of speed, courage, and stamina.

An eminent investigator, as the result of much historical research, credited the existence in Great Britain of many excellent horses, at the time of the Roman invasion, to the far-reaching commerce of the ancient Phœnicians during the period of their maritime supremacy, several centuries before the Christian Era.

The Phœnicians are known to have visited the Mediterranean and Atlantic ports of Spain, and among the principal elements of their commerce were horses. The colonies planted by them in Algeria, Morocco, and other parts of northern

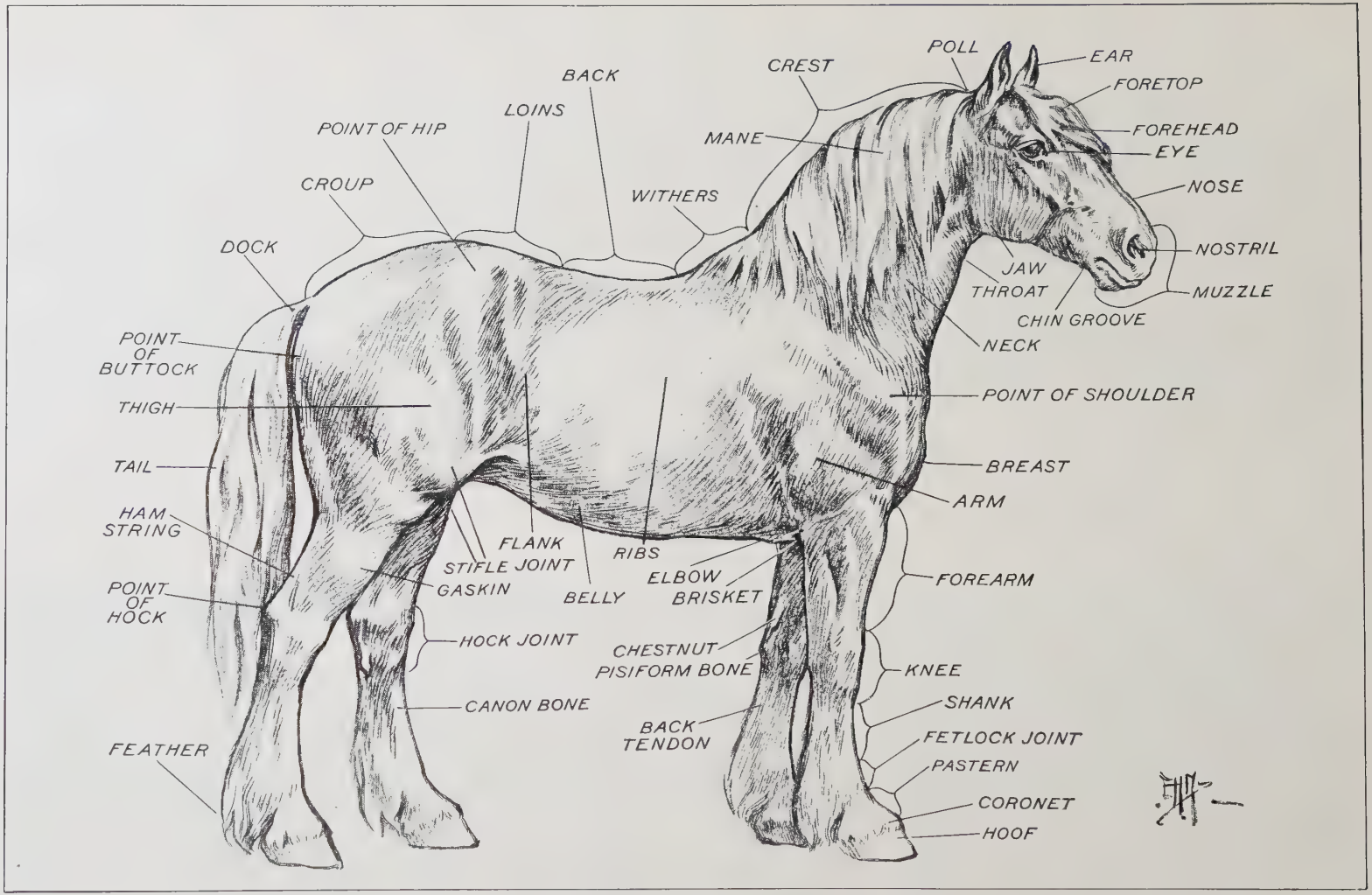
Photograph by Edwin Levick

TROTTING HORSES

Smooth clay tracks, light harnesses, easy-running sulkies, and the skill of the trainers have made American trotters world renowned.

THE FORERUNNER OF THE PRAIRIE SCHOONER

This six-horse Conestoga wagon (see text, page 539) is a survival of the days when commerce moved between Pittsburgh and Philadelphia by horse team.



Sketch by Edward Herbert Miner

A CHART OF THE ANATOMY OF THE HORSE

Africa have been celebrated for the character of their horses since a period antedating the Christian Era many centuries.

It is more than a mere probability that in the course of barter and exchange many Phœnician horses of the type so generally used by the Saracens, and which poured into Spain during its occupancy by the Moors, found their way to the British Isles and became at least a part of the foundation stock on which later importations were grafted to create the Thoroughbred.

The debt for infusions of high-grade blood which the horse world owes to northern Africa has never been fully acknowledged. The Libyan tribes were possessed of horses long before the Arabs were known to have had any, and it is entirely possible that the north African region supplied through Egypt the progenitors of the Arabian horses, which have held their own for many centuries, preserving their purity of blood by persistent inbreeding.

JOHN EVELYN'S DIARY TELLS OF TURKISH HORSES IN ENGLAND

In his remarkable diary, John Evelyn records the early arrival in England of some rare horses, possibly of Arabian ancestry:

"17th December, 1684. Early in the morning I went into St. James Park to see three Turkish or Asian horses, newly brought over, and now first shown to his Majesty. There were four, but one of them died at sea, being three weeks coming from Hamburg. They were taken from a Bashaw at the siege of Vienna, at the late famous raising that leaguer.

"I never beheld so delicate a creature as one of them was, of somewhat a bright bay, two white feet, a blaze; such a head, eyes, ears, neck, breast, belly, haunches, legs, pasterns, and feet; in all regards, beautiful, and proportioned to admiration; spirited, proud, nimble, making halt, turning with that swiftness, and in so small a compass, as was admirable.

"With all this so gentle and tractable as called to mind what I remembered Busbequius speaks of them, to the reproach of our grooms in Europe, who bring up their horses so churlishly, as makes most of them retain their ill habits. They trotted like does, as if they did not feel the ground.

"Five hundred guineas was demanded for the first, 300 for the second, and 200 for the third, which was brown. All of them were choicely shaped, but the two last not altogether so perfect as the first.

"It was judged by the spectators, among whom was the King, Prince of Denmark, Duke of York, and several of the Court, noble persons skilled in horses, especially Monsieur Faubert and his son (provost masters of the Academy and esteemed of the best in Europe), that there were never seen any horses in these parts to be compared with them.

"Add to all this the furniture, consisting of embroidery on the saddle, housings, quiver, bow, arrows, scymitar, sword, mace, or battle-ax, *à la Turcisq;* the Bashaw's velvet mantle furred with the most perfect ermine I ever beheld; all which, ironwork in common furniture being here of silver, curiously wrought and double gilt to an incredible value.

"Such and so extraordinary was the embroidery that I never saw anything approaching it. The reins and headstall were of crimson silk, covered with chains of silver gilt. There was also a Turkish royal standard of a horse's tail, together with all sorts of other caparisons belonging to a general's horse, by which one may esteem how gallantly and magnificently those infidels appear in the field; for nothing could be seen more glorious.

"The gentleman (a German) who rode the horse was in all this garb. They were shod with iron made round and closed at the heel, with a hole in the middle about as wide as a shilling. The hoofs almost entire."

No other reference has come to the writer's attention concerning these animals, but doubtless they were stallions and were used to improve the breed of British horses, along with the three stallions which came into England and to which all Thoroughbreds are traced (see text, page 509).

CRUSADERS' ARMOR GAVE IMPETUS TO BREEDING OF LARGER HORSES

It is not known just what blood was used to build up the heavy British horses,

(*Continued on page 527*)

THE WILD HORSE OF ASIA

(For illustration see Color Plate I)

The only family of original wild horses, not feral or those which have run wild from domesticated herds, known to exist in recent years is the Tarpan, or Przhevalski, which inhabits the steppes of Tatary and Mongolia from the Dnieper to the Altai Mountains, and through the whole of central Asia, in small herds, seldom 50 in number.

The wild Tarpan was given its new designation in honor of the Russian explorer, Przhevalski, after he had identified and classified the small bands found ranging near the borders of China.

The Tarpans are smaller than the domesticated horses, having slender legs, big heads, and large ears, bent back at the tips. The forehead is protuberant above the eyes, with a whorl of hair between the latter. The hoofs are small and almost cylindrical. The mane extends from between the ears to the shoulder blades and is short and upright. The tail is of moderate length. In winter the coat is long, rough, and wavy on the back.

The full-grown horses are quite untamable, but colts may be domesticated. They frequent the open ranges of the steppes. Like other wild animals, they can scent human beings at a distance and avail themselves of their great speed to escape.

The Tarpans, like the semi-wild Mustangs of early frontier days (see pages 521 and 524), separate into small bands, each with a stallion leader. They exist in greatest purity near the borders of China. They are found quite unmixed with the domesticated horse, on the Kara Kum and the Syr Darya, near Kuznetsk, and on the banks of the River Tom, in the territory of the Kalkas, the deserts of Mongolia and the Gobi.

There are some mixed herds within the Russian frontier, in the vicinity of settlements, distinguishable by their variety of color.

Tarpans are not large and their color is usually tan or mouse, in their several shadings. During the winter season the hair is long, heavy, and soft, almost akin to the fur of the bear.

The specimen obtained, and to which the name Przhevalski was given, appeared to be intermediate in character between the horse and the Kiang and Onager (see Plate V and text, pages 481 and 484), having, however, chestnuts on all four legs and only the lower half of the tail covered with long hair.

The general color was dun, tinged with yellow, on the back, becoming lighter toward the flanks and almost white on the belly. The short and upright mane was dark-brown. The head and hoofs were those of the horse.

The Tarpan, or Przhevalski, has many points of resemblance to the horse depicted on the walls of caves in Europe, and on stones and pieces of horn pertaining to the age before the tribes inhabiting the present confines of that region had come to the state of civilization characterized by dwelling in houses and villages.

Scientists have long since established the fact that wild horses existed in the prehistoric age, and historians have assembled much scattered testimony that they continued to range, not only over the steppes of Russia to the foot of the Carpathians, but through Europe down into the period of recorded history.

There are definite references in the writings of numerous authors to the wild horses of Iberia (Spain), the Alps, the forests of Germany and the adjacent countries to the east, to the inhabitants of which region they were permitted as food by the church until interdicted by Pope Gregory III in 732 A. D.

Among the benedictions pronounced by the Monk Ekkehard of St. Gall over the meats to be served in the refectory of the monastery, about 1000 A. D., one refers to the flesh of wild horses. In a Westphalian document of 1316 the fishing, game, and wild horses of a certain forest were definitely apportioned.

In a description of the district of Alsace and the Vosges in 1593, there occurs language of even more interest than some of the earlier references of writers to the horse:

"Horses that be of their kind much wilder and shyer than the stag; yet when they are tamed, which is accomplished with great toil and trouble, they make the very best horses, that equal those of Spain and Turkey, and surpass them in many things, and are hardier, for they are accustomed to cold, and to coarse food, and are sure-footed, being as used to mountains and rocks as the chamois."

It may seem incredible with so much scattered evidence of the continued existence of the horse during many centuries, that none of the older generations of writers should have left a profound dissertation on the history of the horse.

When, however, it is considered that down to within a century there were innumerable references to a fine breed of horses in Spain, known as jennets, not to be confused with the modern name for the female ass, and that to-day no record can be found as to whence the jennets came, or as to their disappearance, by absorption or otherwise, the absence of definite historical records of the ancient breeds of horses should not be surprising.

Fortunate, indeed, is the modern world that the old writers recorded such observations as they did make on parchment; had they used the typewriter and wood-pulp paper of the present age, their work would have been swallowed up in dust and decay, as have been so many other evidences of their existence on earth. The most astonishing thing in the changing world is the continued existence of the written words of the ancients.

There are so many historic allusions in these ancient writings concerning the hunting of wild horses for food and for their skins, within the present geographical area of Europe, that there seems legitimate ground for accepting them as a basis for the definite declaration that there have existed, coincidentally with man during his occupancy of nearly all populated areas, horses, either wild or domesticated from wild stock, and that those horses furnished the foundation for all the improved breeds of the present day throughout the world.

There is no more reason for trying to trace

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Painting from life by Edward Herbert Miner

THE WILD HORSE OF ASIA

them all to a common source than there would be in an effort to find a common ancestral parentage for the bighorn, the mountain sheep, and the domesticated goat.

GRÉVY'S ZEBRA

(For illustration see Color Plate II)

The zebra is recognized as a member of the horse family and is readily identified by its striped skin.

At the present time the several groups to which zebras, differing slightly, have been assigned are all found in Ethiopian Africa. That one to which the name Grévy's zebra has been given is found in Abyssinia and Somaliland.

The Grévy's is the largest and in some respects the most horselike of all the zebras and differs from the others markedly in the width and arrangement of the stripes. The mane extends to the withers, the tail tuft is large and full, and the chestnuts on the inner sides of the fore legs are as small as those of the horse.

As regards the dark-brown or black markings and the intervening light stripes on the body, head, and legs, these are for the most part very narrow, widening out only on the lower jaw, neck, and the lower part of the thighs.

On the flanks none of the stripes bend backward and upward to the hind quarters, the upper portions of which are marked with vertical stripes arranged concentrically round the root of the tail. The dorsal stripe is very broad, especially near the middle of the back; there are no transverse stripes on the underparts. The stripes on the nose stop short of the dark nostril patches and the nose is grayish. The stripes on the rump have their concavity upward, whereas in Chapman's zebra (Plate III) the convexity is upward.

The large, broad, and thickly haired ears are quite different from those of all other members of the zebra family, which are narrow and pointed.

It has been suggested that the large size of the ears and the narrowness of the stripes in this group are probably the result of a life spent in thick scrub. Large ears are very commonly present in forest-dwelling animals, while narrow, vertically disposed stripes appear to be adapted to concealment in the jungle.

Grévy's zebra itself differs slightly in different districts. In those which live in the highlands of the Shoa district of Abyssinia the dark stripes are black and the light stripes are white. In the Somaliland group the dark stripes are chocolate-brown and the lighter bands of a yellowish tinge, the contrast between the stripings being much less than in the Abyssinian animal.

Grévy's zebra averages about 12 hands in height. They are usually found in small bands of ten or twelve and seem to prefer the undulating, rocky bush country.

The heavily striped zebras pertain to the northern groups. The first encountered by the Boers south of the Orange River, which they called quaggas, have the stripes confined to the head, neck, and forward half of the body. Through persistent hunting of this latter group for food and hides, it has disappeared as our buffalo did.

The zebras of Somaliland and Abyssinia are readily recognized by their very narrow stripes. They are shot for food by hunting parties, but are not regarded as game animals. They are easily stalked within the range of modern rifles.

It is not uncommon for the Grévy's zebras to approach the camps of hunters and bray and stamp around to attract the attention of the domesticated animals at night. The bray of this zebra has been described as a hoarse noise varied by a sort of whistle.

GRANT'S AND CHAPMAN'S ZEBRAS

(For illustrations see Color Plate III)

Zululand is the home of a group of zebras in which the body stripes meet the neutral stripes inferiorly, while the legs are more or less fully striped. In this particular group the shadow stripes on the hind quarters are strongly developed and not much narrower than the intervening spaces. The fetlocks and pasterns are devoid of stripes or spots.

In the Chapman's zebra, formerly known as the Matabele bontequagga, the shadow stripes are faint and narrow, the legs are barred to the hoofs, the stripes on the lower portions tending to break up into spots. This group inhabits the country between Damaraland (southwest Africa) and Matabeleland (southern Rhodesia).

On the north side of the Zambezi the group from the plains around Kilimanjaro appears to connect with the more northern groups, retaining slight traces of shadow stripes, which in many cases are visible only on the hind quarters, and having the bars on the pasterns distinct from one another.

Closely allied to the Kilimanjaro group, and really intergrading with it, is the bontequagga of British East Africa (Tanganyika Territory), named Grant's zebra. In this group, as in those of British Central Africa (Nyasaland) and southern Abyssinia, the shadow stripes have completely vanished, and the stripes on the hind quarters are at least equal in width to the intervening spaces, which are white.

In the Grant's zebra the stripes are broad and in some cases completely black, and the bars on the pasterns are fused into a continuous black band.

In certain zebras from the Guas Ngishu plateau of British East Africa, the forelock is entirely wanting, and the mane, except for a small tuft in advance of the withers, is reduced to the same condition as in a hog-maned polo pony, presenting an appearance quite different from that of the ordinary zebra.

A similar peculiarity is observable in the zebra from the Lake Mweru district, and in those of the Guas Ngishu district. These belong to the group of Grant's zebras.

Some of the Guas Ngishu zebras have been found without the mane and forelock, which suggested periodic shedding, but as this does not occur in any other members of the family—horses, asses, mules, or zebras—it is believed to have been due to local and extraneous conditions.

Among the Grant's zebras individuals have been seen in the herds with fawn-colored, unstriped areas immediately in front of the large oblique stripes on the quarters; also, occasionally a white or albino has been observed. These exceptions to general rules occur among practically all animals.

Zebras are essentially animals of the plains, on which they congregate in herds, associating frequently with the gnus, as well as with ostriches.

This association, it has been suggested, may have arisen from mutual advantage, the ostriches by reason of their height being able to see the approach of an enemy in the open, while the others are able to detect the presence of danger through the sense of smell. If one of the trio took flight, the others would be warned to follow suit.

In this connection the effect of the striping of the zebra as a protective element has often been discussed. It is commonly believed that the effect in all the fully striped groups of zebras is to render them inconspicuous at a distance on the plains, and at closer range in moonlight, at dusk, and in the jungle.

The alternate light and dark stripes harmonize with the shafts and streaks of sunlight falling on foliage, and in part the stripes on the body and legs break up the general hard outline of the animal into a more or less indistinct, soft grayish blur.

The optical effect in some of the zebras is to divide the animal into two distinct objects when viewed from a distance and to obscure or completely obliterate the horse outline.

At a distance less than that at which the whole of the stripes melt into a confused gray blur, the general effect is to render the animal much less conspicuous than would be the case if the stripes were of the same width throughout and took the same direction on all parts of the skin.

It has been observed that in nearly all animals that inhabit open plains the legs and under surface of the body are conspicuously lighter than the upper parts, so that when the animal is standing in bright sunshine the light coloring of the lower surface completely counteracts the effect of the dark shade cast by the body and tends to produce invisibility.

The word camouflage has become Anglicized since the World War. Its use on warships and commercial vessels followed the lines of nature in the zebra's skin, and while no painted lines could reduce the outline of a steamship, with its funnels of smoke, to the vanishing point, the arrangement did obscure it very much, made aiming at long range more difficult, and gave a feeling of added security to passengers and crews.

MOUNTAIN ZEBRA

(For illustration see Color Plate IV)

The name Mountain zebra has been applied to the group inhabiting the mountains of Cape Colony, known to the Boers as wildepaard, or wild horse. This group is distinguishable from other groupings of zebras by its asslike appearance, especially the long, narrow ears and the transverse stripes on the hind quarters above the tail. The stripes are white on a black ground.

In addition to these features, the species is characterized by the hairs on the middle of the back, from the withers to the rump, being directed forward instead of backward. The tail tuft is less developed than in other species and the hoofs narrower.

The stripes on the hind quarters are very broad and separated by light intervals approximately similar in width. The transverse stripes on the body are narrow and closely set, and all of them stop short of the middle line of the belly, so as to leave a white space on each side of the longitudinal ventral stripe.

The corresponding dorsal stripe is very narrow and connected with the transverse stripes, most of which run nearly at right angles to this line, although the last two, which are much broader than the rest, are bent sharply backward, so as to cause the uppermost one on each side to form the lateral border of the previously mentioned gridiron.

All the legs are barred down to the hoofs and the chestnuts on the front legs are larger than those of any other member of the horse family.

The throat is peculiar in having a small but pronounced dewlap. There is considerable tan color on the muzzle. The Mountain zebra attains a height of 12½ hands.

This zebra is essentially a mountain animal and formerly inhabited all the mountain ranges of Cape Colony. It is accustomed to traveling over rough and rocky ground and its habits seem similar to those of other zebra groups. Only a few herds of Mountain zebras have survived under government protection.

For many years there was an inclination to assign names to zebras as of many groups, but they are practically the same animal except in the peculiarity of the arrangements of their stripes. They have been used in Africa as food by natives whenever available. They have never been of any material help to man in the cultivation of the soil or as means of transportation. A few isolated cases are known where they have been broken to harness, but they were in no sense equal to the horse or mule. Attempts to cross them on asses and mares of the horse family have produced foals of no value except as curiosities.

KIANG

(For illustration see Color Plate V)

The Kiang and Onager belong to the wild ass species. There is less of definite knowledge of these animals than of almost any other now existing, for the reason that they inhabit the wild and less settled parts of Asia and have never been domesticated.

With very slight changes of coloring, they are found in widely separated areas and always in the deserts or less attractive uplands. They have the form, the solid hoof, the short upstanding mane, and practically all the other

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GRÉVY'S ZEBRA

Painting from life by Edward Herbert Miner

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GRANT'S AND CHAPMAN'S ZEBRAS

qualities essential to class them as members of the ass family.

The Kiang is found in the high and isolated regions of Tibet, in the vicinity of lakes and mountain streams, where it feeds on the coarse and wiry grasses. It is larger and more powerful than the Onager, averaging about 13 hands in height.

The Kiang was encountered by the early explorers of Kashmir. It abounds on the great Changchenmo plain and in the arid country around Pangong Lakes, the feeding grounds of the Tibetan antelope and formerly of the Yak. Its range extends eastward into Tibet.

These barren countries are scorched at midday in summer, but because of the high altitude are bitterly cold at night; nevertheless, the Kiang thrives there.

The Kiang differs radically from others of the ass family in his partiality for lakes and streams, in which he swims in icy-cold water.

The ears of the Kiang are larger than those of the horse, but not so large as those which characterize the ass family generally. The chestnuts, which exist on all four legs of the horse, are found only on the front legs of the Kiang.

The cry of the Kiang approaches that of the neighing horse rather than the bray of the ass and mule. The hoofs are not as broad as those of the horse, but are very flinty and hard, to enable him to traverse the rocky region in which he makes his home.

The Kiangs, like wild horses, range in small bands and do not seem to fear man, for they have frequently been observed to gallop in circles around parties of travelers. The Tatars capture them for food, and occasional specimens have been taken for zoölogical collections, but they remain, generally, as wild as when first known by the ancient people of Asia.

The back and upper parts of the Kiang are of a reddish tinge, in sharp contrast to the white of the muzzle, underparts, buttocks, and legs. In winter the long, shaggy coat of hair tends to obscure the difference in markings so well defined in summer.

In Mongolia the Kiang is replaced by its near relative, the Chigetai (Dziggetai), a smaller and more uniformly colored animal, with more rounded hoofs. The difference in general appearance between this animal and the Kiang proper is due to the less rufous tint of the darker areas in the summer coat and to the fact that this shades off imperceptibly into the dirty white of the under surface of the body and the paler fawn of the throat and limbs.

Having the same narrow dorsal stripe and dark tips to the ears as the Kiang, the Chigetai lacks the dark patch at the base of the ears distinctive of the latter. If not identical with, the Chigetai is nearly related to the Koulan of the Kirghiz Tatars.

THE ONAGER

(*For illustration see Color Plate V*)

Closely allied with the Kiang and Chigetai is the species known as Onager, which signifies wild ass, and which inhabits the deserts of Asia, from Syria and Persia in the west to northwestern India and Mongolia on the east. The Onager is a rather smaller and paler-colored animal than the Chigetai, with nearly as well-marked a contrast between the dark and light areas as in the Kiang.

The Onager stands from 11 to 11½ hands in height; the hoofs are narrower and more asslike than those of the Kiang. The profile of the face may be either straight or sinuous; the tail tuft is of moderate size; the dark dorsal stripe, which is always much wider than that of the Kiang, stops in some cases short of the tail tuft and is flanked on either side, at least in the posterior half of its length, by a whitish band joining the white on the buttocks and the backs of the thighs.

In the summer coat the general color of the upper parts is usually some shade of pale reddish fawn or sandy, while the light areas, which vary from pure white to light-brown, are much the same in extent as those of the Kiang, but embrace more of the buttocks, from which they spread along the margins of the dorsal stripe, and in some cases occupy more of the body and head. In winter, when it grows much longer and rougher, the coat becomes more or less gray, with sharply defined white areas.

With such a wide geographical distribution, it is not surprising to find that the Onager is divided in numerous local branches, each somewhat defined.

Probably the best known of these is the Indian Onager of the desert districts of Sind, Cutch, Baluchistan, eastern Persia, and Afghanistan, and thence north to Bokhara. This Onager attains a height of 11½ hands. To the east of the Indus this animal is found in Bikaner, Jaisalmer, and the saline tract known as the Rann of Cutch.

The Persian Onager, found from western Persia to the southward of the Caspian, has such a development of the white areas, as compared with the Indian type, as to give the appearance of a white animal with large fawn-colored patches on each side. The facial profile is distinctly convex and the ears are relatively small. The light color of the Persian Onager is an adaptation to a desert existence similar to that of the gazelle of the Sahara.

The Onager of Syria and Palestine inhabits the deserts between Bagdad and Palmyra.

On the plains the desert grasses become parched and withered, and in early summer the animals migrate to the hills. They usually associate in small bands, but herds of a thousand head have been observed in Afghanistan.

Unlike the Kiang, the Onager is exceedingly suspicious, very shy, and very difficult to capture or shoot. Like all desert herbivorous animals, the Onager is famed for speed. Those who have aspired to capture one of these fleet creatures by pursuing on horseback until the Onager is exhausted, have found it quite impossible unless relays of horses are provided at objective points, and then the chase is not often successful.

WILD ASSES OF NUBIA AND SOMALILAND

(For illustration see Color Plate VI)

The African ass is found in the wild state in Abyssinia, Nubia, and other parts of northeast Africa lying between the Nile and the Red Sea, and is regarded by zoölogists as the progenitor of the domesticated asses. Its color and markings approach closely to those of the domestic ass. It possesses the distinctive shoulder stripe, running from the withers down to the fore leg, usually observed on the donkey. The ears of the African ass are somewhat longer than those of the Asiatic ass. The bray of the African is identical with that of the domesticated ass and the common mule. The skeleton of the African ass shows only five lumbar vertebræ, as compared with six in the horse. The chestnuts found on the inside of the hind legs of the horse are absent in those of the ass.

The ass of Somaliland differs somewhat from the usual type of African ass in being of a more grayish color and with the absence of the stripe across the shoulders and in the presence of black stripes and markings on both front and hind legs. It also has smaller ears and a tendency to grow a longer mane.

The presence of the leg stripes has suggested to investigators a near relationship to the zebra of southern and southwestern Africa, with which the ass agrees in general form, in the shape of the head, in the length of the ears, and in the narrowness of the hoofs. The ass, however, has lost, if it ever had, the general striping of its southern congener, probably in the same way that the coloring of other animals which have taken up a permanent residence in desert areas has changed to meet the new conditions.

The retention of leg stripes by the ass is in marked contrast to the quagga and bontequagga of southern Africa, in which the leg stripes were apparently the first of the dark markings to disappear in a new environment.

The African wild asses of the present day are divided into races according to their markings.

The Nubian ass, which inhabits the country on both sides of the Atbara River, in the eastern Sudan, to the south of Nubia proper, has a distinct shoulder stripe, but with no dark markings on the legs, with the exception of a patch on the fetlocks.

The Somali ass, on the contrary, has quite lost the dorsal and shoulder stripes, but has the legs fully barred.

In general character wild asses resemble the domesticated breeds, differing mainly in having more slender legs and greater speed. The domestic ass, particularly the small donkey and burro type (see page 488), is known, if not notorious, for his lack of speed, or, if he has it, for his unwillingness to give evidence of it.

The asses, both wild and domestic, male and female, are characterized by a raucous bray. Unlike the Kiang, they have a great aversion to entering water. They subsist on the dry grasses found in the desert areas of northeastern Africa, and this probably accounts for the ability of the domesticated donkey to get along comfortably on the poorest fodder and trash to be found about a farm. Of course, this does not apply to his aristocratic kinsmen kept as sires on breeding farms.

Both the Nubian and Somaliland asses attain a height of about 12 hands. Their conformation clearly establishes their right to be considered as of the original stock from which have come the domestic asses, even though the latter have changed much in form and coloring under the influences of their new environments. The extent of these changes in some cases almost gives certain asses the right to new classification, so far as their movements and their gaits are concerned, but the bray remains of one accord.

Throughout the East the ass is used extensively for saddle purposes. The Syrian ass is especially renowned as a saddle animal and is credited with ability to accomplish long journeys at considerable speed.

The small, patient ass, however, is associated quite definitely in the minds of travelers with the lowly tasks of agriculture and as a burden-bearer, especially as a distributer of wood and water.

The movements of commerce and the trend of populations on the earth's surface comprise the interesting and important events of history, even though they follow so often in the wake of war.

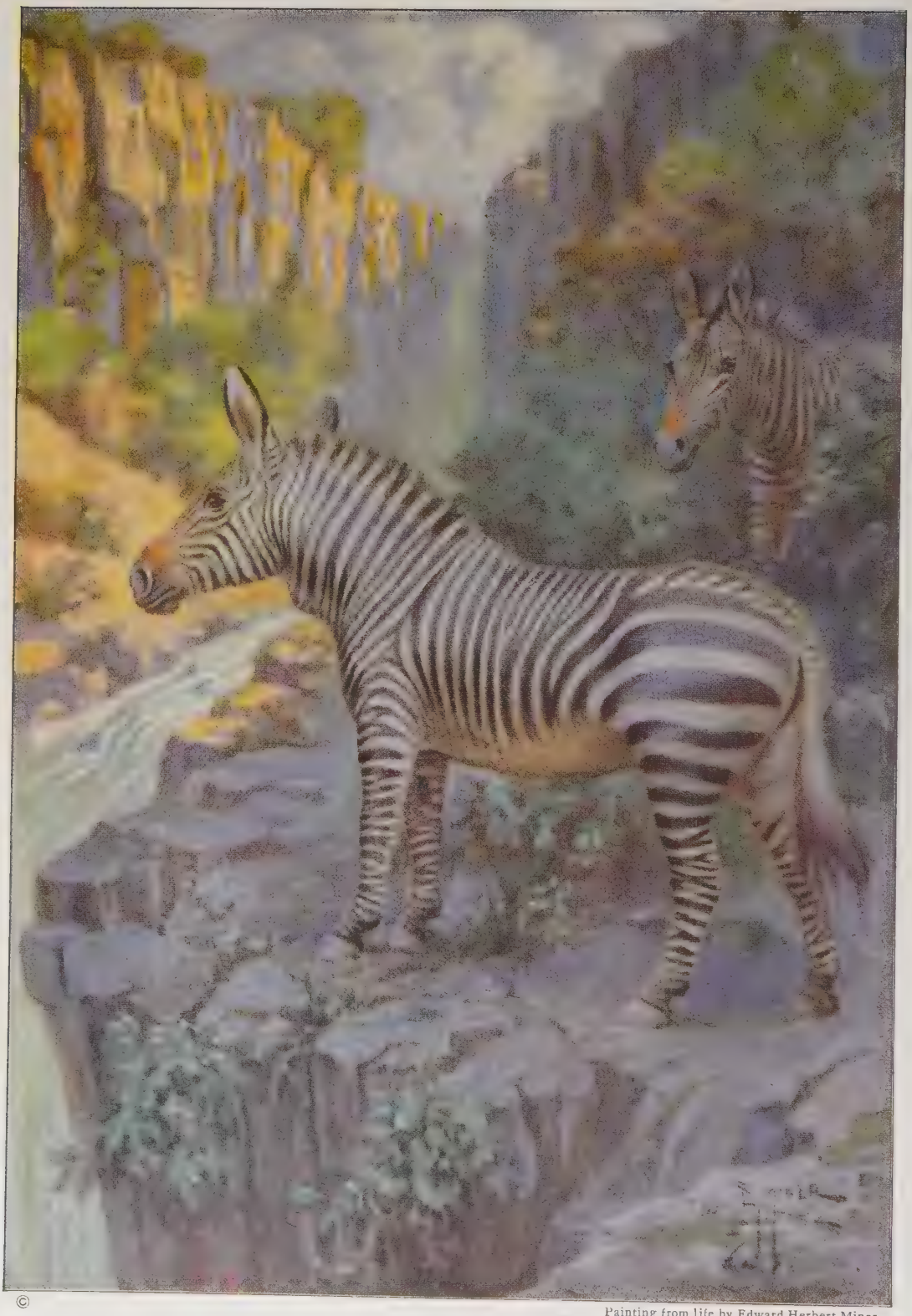
The blending and intermingling of peoples have sometimes created practically new nations, and it is the same with animals, to a certain extent, not in creating new species but in so modifying the old as to make it appear incredible that they should have come from the original stock.

Scientists adhere closely to anatomical significations in their determination of lines of ancestral descent. Without claim as a scientist, my lifelong studies of the horse and his congeners has brought the conviction that the modern world is more indebted to northern Africa for the modern horse, jack, and mule than to all the rest of the world.

Creation of types is not the work of a day or a year; yet so rapid has been the development of breeds of modern horses and mules that we should be able to accept available evidence as to some of them.

To my mind, nothing is more certain than that the native ass of northern Africa was the source of supply of the domesticated ass to all the countries trading along the Mediterranean, first to the East and later to the West, and that the bones of the forebears of the famous asses of Syria, Palestine, Persia, Damascus, and Bagdad have fertilized the soil of Africa in common with those of the forebears of the jacks of Spain, Italy, France, and Kentucky.

The virility of the ass, or, as we now prefer to know him, the jack, has been remarkable through the centuries, not only for maintaining the purity, the quality, and the abundance of his own race, but for adding to the world's available animals that unique, patient, and useful aid to mankind, the mule.



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MOUNTAIN ZEBRA

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ONAGER (left foreground) AND KIANGS

THE DONKEY

(For illustration see Color Plate VI)

Donkey is a nickname for the ass in all parts of the world. Burro is the common name for the small ass introduced in America by the Spaniards, mainly through Mexico. The Jacks of Poitou in France mark the maximum of the species in point of size, while the little Mahratta Donkeys of western India and Ceylon represent the opposite extreme, some of them being only 30 inches, or 7½ hands, in height.

The small gray donkey of northern Africa was without doubt the progenitor of the Spanish Burro, which accompanied the conquistadores to Mexico and South America and which has played such an important part in the settlement of the great West.

The true Wild Ass is found only in northern Africa. There is no evidence that the wild animal ever existed to the eastward of the Red Sea, and it is regarded as reasonably certain that the asses, or donkeys, were domesticated on the shores of the Mediterranean Sea, and found their way to the East, and later to all parts of the world. The Donkey is essentially a southern animal, partial to hot and dry countries.

The domesticated asses are now spread over southern and central Europe, the whole of eastern and southern Asia, northern and eastern Africa, and North and South America.

By careful selection, the Donkeys are now recognized as distinct breeds of quite different types. Syria is said to possess four quite distinct breeds: a light and graceful type, with a pleasant, easy gait, used by ladies; a so-called Arab breed, reserved entirely for the saddle; a stouter and stronger type, used for agricultural purposes, and the large Damascus ass, characterized by great length of both body and ears.

Many of the Damascus Donkeys are white and apparently akin to those of Bagdad, which have been highly esteemed for centuries, both on account of their color and speed.

The Syrian Donkeys are credited with excellent saddle qualities. While their speed is not great, they will continue an easy trot and canter for hours. In Biblical times many herds of asses were maintained mainly for their milk.

While the asses of Spain and France have taken on dark colors, the usual colors of the donkeys of Egypt, Persia, India, and other parts of the world are of a grayish tint, many being almost white.

The Donkeys or Burros, as quite universally called in the Western States and Mexico, have been clubbed, beaten, cajoled, and threatened ever since they landed upon the shores of the Gulf of Mexico; yet they have gone along patiently, carrying the burden of the white man through three centuries.

Not big enough to cut much of a figure in harness, the little Burro has shown masterful qualities under the saddle and aparejo. The quantity of wood, hay, and other articles of barter and trade which a Mexican packer can tie on the back of a diminutive Burro is and always remains beyond belief to those who have not personally seen the performance.

As the friend and burden-bearer of the army of prospectors, from the eastern slope of the Black Hills to the Pacific and from Canada to Mexico, the Burro shares the honor of discovery and development, for without his uncomplaining services that vast region would have remained long unexplored.

In a vastly different field of usefulness the Burro shares with the Shetland pony the honor of being the children's friend. In America the number of Shetlands is small in comparison to the number of Burros, and each Burro seems able and willing to carry as many children as can pack themselves between his ears and tail.

Then, too, they are very patient and gentle and seem able to sustain life on the smallest possible amount of pasturage.

In Mexico the Burro has been mated with Mustang mares and has produced a remarkable breed of hardy, active, small mules, which were used in the freight "schooners" of the Southwest for many years before the railroads were built. It was not uncommon to see from twelve to twenty in one team, hauling a large wagon with a trail wagon attached. No forage was carried for them. After the day's drive they were turned loose for the night, under a herder, to procure their provender by grazing.

Being quick and active, they were superior in every way to their progenitors, the Mustang and Burro, which in combination were able to produce a better draft animal than either of them individually.

SHETLAND PONY

(For illustration see Color Plate VII)

The Shetland Islands are situated about 100 miles off the north coast of Scotland. Only a few of the large group of islands are inhabited, for the land is poor and unproductive. Just how much environment has had to do with the size and character of the ponies there and whether they are from original Shetland stock remain, like similar questions in all parts of the world, without possibility of definite solution.

The Shetland ponies have long existed under most adverse conditions, being close companions of the natives of the islands, not infrequently sharing their huts and even their provisions.

The ponies are characterized by diminutive size, hardiness, and good dispositions. They are accustomed to deprivations, for grazing is scarce, which accounts somewhat for their small size.

The Shetland is of the draft-horse type in miniature and gives the maximum of horsepower in the smallest compass. While not used to any extent for farm work, the Shetlands have long been employed for draft purposes in coal mines, and, notwithstanding their diminutive size, they are able to draw half a ton of coal and cover from 20 to 30 miles a day.

They are wonderful weight-carriers, a Shetland three feet in height being able to carry a full-grown man on his back for long distances. The crofters habitually use them for packing peat, and their customary load is from 120 to 140 pounds. This is remarkable when

it is considered that the average height of these ponies is about 40 inches, and some very much less. None is eligible to registration in the Shetland Pony Stud Book which exceeds 42 inches in height at four years of age.

When used for draft or as a pack animal, the Shetland comes into his own at once. Weight for weight and inch for inch of height, he can hold out against all the horse world. Working under stress of weather conditions and insufficient forage, he has no equal. Measured all around, his good qualities so outweigh any deficiencies that the latter are completely forgotten.

It is now usual to give the ponies a ration of hay in the winter, when the vegetation is covered with snow, and obviate the losses by starvation, which formerly were quite heavy in severe weather. Otherwise, their conditions of life on the islands differ little from those that prevailed three centuries ago. When not at work, their lives are usually spent in the hills, grazing.

When taken from their native islands to breeding farms where good forage abounds, their tendency is immediately to lose their diminutive size, which is objectionable when they are intended for the use of small children. If not pampered by good pastures and warm stables, they retain their diminutive characteristics.

They do very well on land unsuitable for grazing steers for market. They do not require as much attention as sheep or goats, do not eat any more, and sell at greater profit.

Bay, brown, and dull-black are the most prevalent colors, but there is often a mixture of white. Piebalds find ready sale for children's ponies, especially in America. In winter the coat is long and shaggy, but in summer the hair is short and sleek.

The demand for Shetlands for children has been very large for many years. Any kind of a pony looks good to a child, and as a mere toy they seem to answer, regardless of the fact that a herd of Shetlands, taken at random, will show more defects as saddle animals than almost any other breed of horses.

Some judgment is required in selecting a pony, but parents generally are solicitous only about a kind disposition. The Shetlands are as sure-footed as mules and as patient as donkeys, intelligent and faithful. Their docility enables them to put up with the whims of children without resentment or rebellion.

Few of the Shetlands have what is termed the saddle-horse conformation; they are usually of the blocky type. They are short in the leg, wide in the body, short in the back, with large bones, thighs, and arms, all of which qualities are in the direction of great strength for size.

When children have passed 12 years of age and it is desired that they shall become accomplished horsemen, the Shetland should be relegated to the use of the younger members of the family and a selection made from one of the more active breeds of ponies or, preferably, of a small horse of saddle type.

In recent years numerous breeding farms devoted to the Shetland pony have been established in England and Scotland, as well as on some of the detached, small islands. In America, also, breeding of the Shetlands has received much attention in many States and the total number has assumed considerable proportions.

All breeders wish to give proper care to their stock and all have the same experience with the Shetland, which insists upon reducing his most valuable asset, his diminutive size, by getting bigger as soon as fed like other animals. They are lovable little beasts and everybody wants to pamper them.

It is generally believed that ponies are more intelligent than horses. Whether this would prove true where both are reared under exactly similar conditions may well be questioned.

The Shetland, on his native islands, is foaled and grows up under very hard conditions of life, and it is doubtless the necessity for looking out for himself which has developed exceptional intelligence, transmitted later as a heritage to the new foals.

NORWEGIAN DUN

(*For illustration see Color Plate VIII*)

Tracing the history of the horse in all countries has been a favorite study of scientists. Inclined to regard the Norwegian Dun as one of the original breeds or, in any event, as a near relation, they have expended much effort in trying to identify the particular strains involved, but no very definite result has followed.

The color of the Norwegian is very much like that of the wild Tarpan (see Plate I); and this, taken with the dorsal stripe and black fetlocks, with frequent traces of a shoulder stripe and barring of the upper part of the legs, lends encouragement to the view that they are akin to the original stock of northern Europe.

On the other hand, it has been suggested that the blood of the north African horse, first carried from the Mediterranean into central Europe, and thence to Norway, has asserted itself in the common markings and absence of certain leg chestnuts as the probable influential strain in perpetuating the existing Dun breed.

The evidence in neither case is sufficiently definite to prevent investigation from running into numerous blind trails.

From the earliest recorded Scandinavian history there have existed horses in Norway, the prevailing color being dun, with the dark stripe along the back. One of the early writers remarked that while the horses of Sweden were particularly well adapted for use in marshy and forest country, those of Norway, although of moderate size, were strong, courageous, and excellent for service in mountains and rocky ground.

Notwithstanding all the years of opportunity for admixture of other blood, the modern horse of Norway still shows the prevailing color, dun varying from cream color to dark dun. None is considered purely bred unless it has the spinal and leg stripes, the facial stripes being extremely rare.

Whether the dun color comes from its relation to the wild Tarpan breed or from affinity with the dun-colored horses of Spain and

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NUBIAN AND SOMALILAND WILD ASSES

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SHETLAND PONY

southern Europe, derived originally from Africa, the Norwegian Dun continues to be a remarkably prepotent horse, of moderate size, well rounded, with clean head and legs, strong, courageous, and very sure-footed.

Scientists are inclined to the belief that the wild Tarpan is related not only to some of the existing horses of western Europe, but also to their prehistoric ancestors. This is one of the reasons for the belief that the Norwegian Dun represents a very ancient type and inherits its color either directly from or by reversion to the wild Tarpan.

The Norwegian Dun is a trotter, and this led at one time to the importation of a number of mares from Norway to England to be mated with Norfolk stallions, an English breed of trotters of considerable renown.

ICELAND PONY

(*For illustration see Color Plate VIII*)

Iceland was occupied by adventurous Vikings at the end of the ninth century, but the first colonists were nothing more nor less than sea-rovers or pirates. Many of them, of Norwegian extraction, had previously settled in the British Isles, calling themselves Norsemen. Many had lived for a generation in Scotland, Ireland, the Hebrides, and the Orkneys before settling in Iceland.

It is probable that the original breed of horses in Iceland was due to the Norse migration and was of mixed origin, in which the Hebridean and Scandinavian blood predominated, but there has been no admixture of foreign blood since the first settlement of Norsemen.

The Celtic pony of Iceland is similar to the ponies existing at an early day in northern Ireland and the Hebrides. It is characterized by its small size, a small head, and slender limbs, and sometimes by the entire absence of the chestnuts on the hind legs and the peculiar short hairs in the upper part of the tail.

After isolation for upward of a thousand years, the Iceland ponies retain a marked degree of prepotency when mated with other breeds.

It is entirely probable that the Icelandic and Shetland ponies were once identical, but the Shetland has been subject to admixture of other blood from Scotland and elsewhere for many centuries. The ponies of Iceland have been very isolated until within the past 50 years, when some were exported to England for use in the coal mines.

A typical Celtic pony resembles closely in markings and color the wild horse of the Altai variety (see Plate I), being of a yellowish dun with a dark stripe on the back and sometimes with indications of stripes on the shoulders and in the region of the knees and hocks.

The hair of the Celtic pony is rather longer during winter, especially under the jaw, over the hind quarters, and upon the legs. The mane grows from nine to ten inches every year and reaches a considerable length, only a portion being shed.

A remarkable feature of the Celtic pony is the tail. The dock or solid part is relatively short, but grows long dark hairs until they trail on the ground. During winter and spring the upper third of the dock, about four inches, bears stiff hair from three to six inches in length, which forms a fringe or tail lock.

Usually the upper portion of the dock in other horses is covered with short hair like that over the hind quarters, but in the Celtic pony the wiry hairs extend to the top of the dock.

The presence of this unusual bunch of hair at the root of the tail serves a very useful purpose to the pony during snowstorms. By turning its tail to the direction from which the storm approaches, the bunch of hair spreads out in the form of a disk, to which the snow adheres, forming a shield which prevents snowflakes from getting under the tail, where they would soon melt and run down on the inner surface of the hind quarters, which, being only thinly covered, would produce chill.

This protection, with the heavy mane and long hair on the back and hind quarters, enables the Icelandic pony to withstand the severest weather without serious results.

Without their ponies, the people of Iceland would have had to confront almost insurmountable obstacles, for the population was never large enough to utilize man-power for the heavy work performed by the hardy little animals. The food supply of the population is entirely dependent on the ponies, which transport the wool to the coast and bring fish, grain, wood, metal, and nearly everything else back to the farms that produce mainly sheep and potatoes. The fish come from the surrounding seas, all else from abroad.

Iceland is about one-fifth larger than Ireland, yet the ponies are the only reliance of all the interior. The pony pack-trains are sometimes tied in a column, tail to head, and move along over mountains, through marshes, and across rivers, indifferent to fatigue, requiring nothing more than a dog to keep them in the trail.

Everybody rides. To walk is considered derogatory to one's dignity. To pay a call on foot is regarded as a breach of good manners. Even the beggars, who through misfortune or laziness have not sufficient for their families, ride around to the neighbors to receive alms. Without the ponies, one simply could not exist in the interior, far back from the coast.

The ponies are not fast, but no work to which they are normally subjected seems too hard for them. When it is considered that they live by grazing in summer, with small amounts of hay, supplemented by the heads of dried codfish in winter, their endurance is truly remarkable. They seem to thrive on such diet, for they have often been observed to make their way to the shore, looking for dead fish cast up by the sea.

While nearly all colors are represented in Iceland ponies, even piebalds occurring at times, the most typical color is the light-dun with a dark stripe along the back.

Mares are generally used for riding purposes, and the best of them are taught to amble, if not born with the tendency to that easy gait, which makes long journeys more comfortable.

THE WELSH PONY

(*For illustration see Color-Plate IX*)

The British Isles have always been possessed of numerous breeds of ponies, each having its admirers. The New Forest, the Exmoor and Dartmouth, the Cumberland and Westmoreland, the Irish Connemara, the Welsh and the Shetland are rivals for public favor, but the two last named are justly famed, each in its own field.

The Welsh pony is a typical range horse of small size, and has been held in high esteem since a very early period, for his soundness of constitution and his powers of endurance.

These are qualities which are usually developed in animals brought up on the open range. It has long been observed that army horses in campaign suffer very little from ordinary diseases, and that the great losses incident to hard service are usually attributable to starvation and overwork and not to life in the open air.

The writer commanded a troop of cavalry during the last Indian war, involving a campaign in midwinter, and did not lose a horse. It was observed in the spring, when the horses began to shed, that nature had provided them with exceptionally heavy coats of soft hair.

For centuries the unfenced lands of Wales were the grazing grounds of numerous herds of ponies, which adapted themselves to the rough hills as well as to the wet and boggy waste lands, and became noted both for hardiness and sure-footedness in any and all situations.

The true type of Welsh pony resembles a coach horse in miniature, and usually has a good head, neck, and forehand, well-formed legs, and considerable speed at a trot, with very free action.

Many efforts have been made to improve the breed of Welsh ponies by increasing their size. In the first quarter of the eighteenth century there was a small race horse in England that had beaten every animal that started against him. When retired from the turf he was purchased and turned out to run on the range in Wales with the semiwild ponies. So remarkable was the improvement in the herd headed by this stallion that the value of all the ponies of the locality where he ranged was materially increased.

More than 100 years later many small Hackney stallions were taken to Wales to cross with the ponies to meet the demand for fast trotting harness and saddle horses.

All these efforts were more or less local in application, and a Royal Commission on land in Wales, a little more than 20 years ago, reported the old conditions little changed. It was found that on the mountains of North Wales, which were formerly famous for wild herds of "Merlins," a name given to the descendants of the small race horse turned out with the ponies more than 200 years ago, little improvement had taken place, due to the careless treatment of the herds of ponies, which are allowed to ramble at will, winter and summer, to survive or starve, according to weather conditions. No attention had been paid to breeding, the herds being allowed to run wild.

The endurance and constitution of the Welsh ponies are proverbial, and if they had been sheltered in winter and some attention given to selection in breeding, an entirely different story could have been told. There was abundant material to make use of and the breeding might have become a source of continuous profit.

Attempts have been made to improve the range ponies by introducing Arabian stallions, but the result did not compare with that which was produced by Thoroughbred stallions mated with selected Welsh pony mares. Some of these were developed to sufficient height for Polo ponies, but the present tendency to use Thoroughbred horses, without regard to height, discourages the breeding of ponies for the game.

While the pure-bred Welsh pony is not much larger than the Shetland, he is in reality very much more of a horse and would not be recommended for the use of small children.

The pure-bred Welsh pony is about twelve hands, or 48 inches, in height and usually bay or brown in color. Many creditable performances in the way of endurance rides have been reported, one, for instance, where a full-grown man rode a Welsh pony 10 miles in 47 minutes, taking 30 jumps in the course of the run.

THE ARABIAN HORSE

(*For illustration see Color Plate X*)

The early history of the Arabian horse is shrouded in that impenetrable veil beyond which investigators have been unable to discover a satisfactory path to knowledge.

Recognizing the Thoroughbred as a fixed type of highest quality, resulting from painstaking and careful mating to obtain particular results, many students are agreed that the Arabian might have been originated and perpetuated in the same way. On the other hand, the Arabian and the Barb of northern Africa are so alike, and yet so distinct in every possible way from the ancient horses of the steppes and of the European areas, that admirers of the Arabian and Barb are unwilling to assign them to any but a distinct classification of their own.

The writer is thoroughly in sympathy with this latter view, and the only question which seems open to legitimate discussion is whether the Arabian and Barb are not identical in species and race, and if that be decided in the affirmative, to determine which is the more ancient in origin and to what region it should be assigned.

There have been many hundreds of books written on the horse. A lifetime devoted to the study has brought the conviction that a large majority of these writings, as far as examined by me, contained little original matter, and that those which may be regarded as authoritative must be considered in the broad light of recorded

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NORWEGIAN DUN AND ICELAND PONY

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WELSH PONY

history and of scientific discoveries in order to assign a correct value to their conclusions.

The preponderance of evidence favors the belief that the Arabian horses were obtained through Egypt, from the Libyan tribes of northern Africa, and that by long and careful mating the superior type of Arabian horse has been maintained through many centuries.

This conclusion may be justly reached by considering only the caravan movements and war invasions. When to those are added the water-borne commerce of the Mediterranean and the probabilities of the transfer of the Barb to the east, and in the course of centuries back to the west and north of that great inland waterway, the matter resolves itself into an entirely possible solution, conformable to the history and development of European civilization.

It would be difficult for any horseman to adopt the suggestion of some scientists, that the Arabian might have been descended from the Tarpan, the Onager, or the Zebra. Certainly the Onager and Zebra have been known for more than a thousand years, and no one has been able to transmute them, by interbreeding, into any kind of a horse. Had they any legitimate claim to such noble ancestry, the Arabians would have shown dun colorings, stripes, and bars, all of which are conspicuously absent.

Unhesitatingly the Arabian and Barb are assigned to their own species unfouled by such ignoble forebears.

The Arabian, and his undoubted kinsman the Barb, are desert horses, accustomed to subsist upon scanty food and little water. They are continually exposed to the heat of the desert sands, yet are hardy and capable of covering tremendous distances carrying loads equal to one-fourth their own weight. They are bred and raised in close contact with the families of their masters, and are renowned for affection, gentleness, and tractability.

The characteristics of the Arabian horse differentiate his type in the most marked manner from other breeds. His difference from other horses is not alone in conformation, but in the anatomical formation of the skeleton, which contains fewer vertebræ in the back and tail than other horses. The usual callosities of the hind legs are very small and sometimes nonexistent, and those on the front legs are also of small size. The ergots on the fetlocks are very small, sometimes hardly distinguishable.

The Arabian is distinctly a small horse, of from 14 to 15 hands in height, usually higher at the croup than at the withers.

The head is large in its upper half, in proportion to the size of the horse, and it diminishes rapidly to a small and fine muzzle. The lips are thin and fine. The nostrils are long, thin, and capable of great dilation. The face is slightly dished below the eyes. The large, lustrous eyes are set far apart. The cheekbones are wide apart at the throat, enabling the muzzle to be drawn in without compressing the windpipe and interfering with breathing when running. The ears are small and pointed and of great flexibility.

The neck should be long, arched, light, and run back into the withers, which should be high and well muscled. The shoulders should be long, deep, and powerful. The back is unusually short, the haunch longer in proportion and quite horizontal; the tail set on high and carried in the air when the animal is in motion.

The fore legs are characterized by a long and muscular fore arm, large knees, short cannon bone, with heavy tendons; fetlock joint large; pasterns long and sloping; hoofs hard and round. The hind legs are well muscled, with hocks large, almost abnormal in size; shank bone flat, clean, and short, with large tendons. The pasterns are long, sloping, and muscular and the fetlock joint of exceptional size.

The mane and tail are long and fine; the hair of the body soft and silky. In color Arabians are bays, grays, chestnuts, browns; solid white is prized, but rarely found. Among Arab proverbs is one regarding color: "The fleetest of horses is the chestnut; the most enduring the bay; the most spirited the black; the most blessed the one with a white forehead."

A horse that clears only 10 feet at his first forward spring is set down as heavy; if he covers 15 he is considered strong, and if he exceeds the latter he is deemed of superior quality.

A horse from the mountains is preferred to a horse from the plains, and one of the latter to one from marshlands, which is deemed fit only to carry a pack. The war horse must have good sight and be able to travel at night.

The highest virtue in a horse, in the mind of the Arab, is endurance, to which, in order to constitute a perfect animal, must be joined strength and wind.

To summarize in the words of Abd-el-Kader: "If in the course of your life you alight upon a horse of noble origin, with large, lively eyes, wide apart, and black, broad nostrils, close together; whose neck, shoulders, haunches, and buttocks are long, while his forehead, loins, flank, and limbs are broad; with the back, the shinbone, the pasterns, and the dock short; the whole accompanied by a soft skin, fine, flexible hair, powerful respiratory organs, and good feet, with heels well off the ground, hasten to secure him if you can induce the owner to sell him, and return thanks to Allah morning and night for having sent thee a blessing."

THE HACKNEY

(*For illustration see Color Plate XI*)

The Hackney has long enjoyed preëminence as the head of the heavy harness breeds of horses of the world. The Hackney, like the Thoroughbred, is of English origin and of composite blood, which, after two centuries of breeding, reproduces itself to perfection in both form and color.

It is astonishing to what extent Arabian horses have influenced the improvement of many different types of horses, resulting in the creation of most important breeds. Of these the Thoroughbred and the Hackney are the most important examples.

Mr. Darley imported into England during the reign of Queen Anne an Arabian horse, known since as the Darley Arabian, whose blood lines

are treasured as a priceless heritage in the family tree of long lines of Thoroughbreds and Hackneys.

In 1714 a mare, Betty Leedes, was bred to the Darley Arabian, and the result of that mating was Flying Childers, the fastest horse of his day. A son of Flying Childers, Blaze, foaled in 1733, also famous for his speed, was retired to the stud in Norfolk, noted for its good native stock.

The celebrity of Norfolk as the home of the Hackney is mainly due to the happy combination of the blood of Blaze with that of the Norfolk mares, long valued for their harness qualities.

The Hackneys present a striking illustration of the high degree to which the art of horse-breeding may be carried, for many of them are magnificent animals, combining extremely high trotting action and fair speed with substance and quality.

While the Hackneys inherit their fine qualities and the high action which make them desirable as heavy harness horses, skilled training, bitting, and shoeing are necessary for their development, especially when destined for the show ring.

Hackneys are heavy in proportion to their height, when compared with other light breeds, their deep chests, well-sprung ribs, low flanks, and heavy croups and quarters all producing weight. In size the Hackney varies more than any other light breed. The small Hackney pony and the 16-hand Hackney horse are both registered in the same stud book. Most of the demand for heavy harness horses is for show-ring purposes, and, to meet this, pure-bred Hackneys are desired.

When carriage horses were in demand in this country, both pure-bred and gray Hackneys were supplied. Crossed with trotting-bred mares, Hackney stallions have sired many high-class carriage horses.

Among Hackneys, chestnut is the predominating color and is much preferred. Bays, browns, blue and red roans and, very rarely, grays are the other colors found. The French importers seem to have a preference for the browns. Roans are generally very hardy and useful horses of any breed, but sorrels and chestnuts, especially when accompanied by white stockings and blaze or snip, are far more showy in the ring.

In the show ring and for carriage use, Hackneys are usually docked and have their manes pulled.

The American Hackney Stud Book contains the records of 2,077 stallions and 3,469 mares. The practical withdrawal of carriages and all types of family vehicles of the horse-drawn variety from city streets and their replacement by motor cars has had a more marked effect on the heavy harness horses than any others.

American cities have grown abnormally in recent years. The nearer the street surfaces approach perfection for automobile traffic, the less satisfactory they are for the horse traffic. The general adoption of closed cars, which shelter the chauffeurs from storms and cold, has relieved those whose social duties admit of no considerations of weather from worry and anxiety over exposed horses and coachmen. In this particular and for long-distance runs, the horse seems destined to permanent replacement by the motor car.

THE GERMAN COACH HORSE

(*For illustration see Color Plate XII*)

The German Coach Horse, as known in America, is the largest of any of the heavy harness breeds, weighing as much as 1,500 pounds in some cases, with fine harness form, but not quite up to some others in style, pace, and action. Some of them are inclined to the draft-horse type, but the more refined individuals are very impressive in coach harness and go well. They are usually of solid color, bay, brown, or black, with very little, if any, white.

Some Thoroughbred blood has been used in Germany, but as a rule the German Coach Horse shows very little of the influence of that cross.

The German states have been breeding large horses for mounting heavy cavalry since the days of the knights in armor. The origin of these horses is somewhat obscure, but they were evidently akin to the heavy Flemish horses, used so much for crossing in the days when a knight and his equipment weighed upward of 400 pounds.

For many years the present type of German Coach Horse has been kept pure in breeding and the stallions have established considerable prepotency, but, being a cold-blooded breed, they cannot be satisfactorily mated with mares of the draft type and should not be mated with mares larger than the horse.

Many high-class harness horses have been obtained by mating the Coach stallions with mares of Thoroughbred or Trotting blood possessing qualities lacking in the sire. The sires introduced in America have come, generally, from Oldenburg and East Friesland.

A stud book for these horses is maintained in America under the name of the German, Hanoverian, and Oldenburg Coach Horse Association. Only 2,955 stallions and 588 mares have been registered to date.

While the German Coach Horse is a very good general-purpose farm and heavy-harness horse, the stallions have not seemed to fulfill expectations in crossing on American mares. This is not surprising, for the only breeds that for a thousand years seem to have possessed the warm blood which "nicks" with other breeds are the Barbs and Arabs or those which carry their blood in prepotent quantities.

AMERICAN SADDLE HORSE

(*For illustration see Color Plate XIII*)

The American Saddle Horse, as known for many years, was a horse of many gaits and of such refined training that he would change from one to the other at the indicated desire of his rider. The demand, especially in the North, for a walk, trot, and canter horse has led to some sacrifice of other gaits, whether

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ARABIAN

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HACKNEY

natural or artificial, and to-day either or both types of saddle horses are supplied to meet the demand.

The walk, trot, and canter are gaits natural and common to all breeds of horses. What are known as saddle gaits, while not easy to describe, have been familiar to horsemen as the rack or single foot, the running walk, and fox trot. These easy gaits have long been known in America and were undoubtedly known in England before the settlement of this continent took place.

A preference for such gaits in the South, a land of large plantations and long journeys, was evinced before the Thoroughbred had become a recognized and fixed type; but the finished, beautiful American Saddle Horse of to-day is a development due to a commingling of Thoroughbred blood with that of the best of the old pacing, racking, ambling, fox-trotting saddle horses in use by the planters and stock-raisers of certain regions of the South.

To the Southerner, who never rode with short stirrups and who regarded rising to the trot as a heathenish invention of the English, his riding animal was a saddle horse, which meant a gaited horse capable of taking him on long journeys, especially in the hot season, with a minimum of discomfort.

While the easy-gaited horse was long known, the development of the present upstanding, beautiful American Saddle Horse is quite modern and has been based upon ideals in conformation and quality as well as performance.

In the Thoroughbred and trotting horse families, beauty of conformation was pleasing, but speed and winning stamina fixed the goal toward which all breeding was directed.

The modern American Saddle Horse now traces quite definitely to a Thoroughbred sire which was mated to a pacer, the daughter of a pacer. This sire, Denmark, mated to a daughter of Cockspur, produced Gaine's Denmark, the greatest of saddle-horse sires; to him all registered saddle horses of to-day trace their lineage.

Denmark was a Thoroughbred, by imported Hedgeford, and was foaled in Fayette County, Kentucky, in 1839. While his races were characterized by stamina and unusual gameness, he never achieved any great fame as a race horse. His reputation as a sire is mainly based upon one of those fortunate and historic matings in which the great qualities of both sire and dam were reproduced in the colt. The Stevenson mare, the dam of Gaine's Denmark, was a natural ambler, and to her must be awarded the palm of credit for the wonderful gaits of her descendants, while to Denmark is due much of the quality and appearance of the sons and daughters of many subsequent generations. Certainly, Denmark is entitled to no credit for the gaits so easily attained by descendants of the ambling mare.

The writer has a dim memory of the great excitement created at Belle Meade, the great Tennessee nursery of Thoroughbreds, by the birth of a pacing foal; but, having never heard of another one since that colt was shown at the old fairgrounds at Nashville, during the last exhibition before the Civil War, he is unwilling to credit his lifelong belief, and accepts the well-known result of experience, that no Thoroughbred blood accounts for any gaits except the walk, trot, and gallop.

An analysis of the breeding of all the horses registered in the first volume of the American Saddle Horse Stud Book shows that of 1,083, only three were Thoroughbreds; 50 were half Thoroughbred, more than 800 a quarter or less, and a large number with uncertain or very little Thoroughbred infusion of blood.

There were many gaited stallions and mares reproducing their qualities long before any infusion of Thoroughbred blood entered the veins of the five-gaited horses, and the distribution of these easy-riding animals was general in the South.

The horsemen of J. E. B. Stuart, Forrest, Wheeler, Morgan, and other Southern cavalry generals were credited with ability to raid around the Union armies because of their Thoroughbred mounts. Confederate cavalrymen were required to furnish their own horses, but very few used Thoroughbreds, the vast majority being gaited saddlers and the balance hunters.

In the early days of hunting in England as well as in America, it was not unusual to ride ambling horses in following the hounds. Of course, when the half Thoroughbred hunters had established their preëminence for that particular sport, no one wanted any other type.

During nearly a quarter of a century in the cavalry service, the writer became somewhat acquainted with the merits of the walk, trot, gallop horse, and of the disadvantage of undertaking to regulate its gaits to conform to those of a fox-trotting or single-footing leader. Nevertheless, he admits his marked partiality for the five-gaited horse out of ranks, and would regard it as misfortune to the nation to have the single-foot and running walk eliminated from the schooling of our saddle horses.

Those who ride only to keep in training for the hunting field may be properly excused, but those who have been advised to pause in their business careers and take up horseback exercise may well begin by learning the art of riding a gaited saddle horse, and then begin to live all over again. If it does not make them better and more useful citizens, it will at least make them more contented with life and less critical of the small faults of their families.

It is a very old saying that "the outside of a horse is good for the inside of a man." The writer began his military career as a mounted messenger, or dispatch rider, with the army at 12 years of age, when he was furnished with a wonderfully trained saddle horse. It is certain he had no Thoroughbred blood, for he was a dark gray with a white face and white legs. It is a far cry back to 1864, but the memory of that mount still clings and makes many others seem poor by comparison.

As the years passed, I found it quite necessary, as a general, to be mounted upon a Thoroughbred charger and never had to apologize for "Phœnix Park." In order to get the full application of the adage quoted, I alternated

in riding by using "Phœnix Park" one day and "Quenton," a five-gaited Kentucky saddle horse, the next, and kept it up until retired for age.

If any man for whom horseback riding has been prescribed desires the full benefit of it, I recommend to him to ride alternately a gaited saddler and a walk, trot, gallop horse, and if there remains any part of his anatomy unexercised at the close of the week, he can swim on Sunday.

If every one who needs to ride a gaited saddle horse should enter the market at once, the demand might exceed the supply, but the report of the American Saddle Horse Breeders' Association shows that on January 1, 1921, there were registered 8,782 stallions and 14,826 mares. These are all pure breds, and it is safe to conclude that the half- and quarter-bred saddlers exceed the pure breds in number, and while some are better than others, they are all good.

THE SUFFOLK

(For illustration see Color Plate XIV)

The Suffolk has long existed in England and is often referred to as the Suffolk Punch, a cart horse of many good qualities. A century ago the Suffolk was regarded as the most active, steady, and powerful draft horse in England.

From 15 to 16 hands in height, a rather coarse head and short neck; shoulders round, breast full, and body long, with well-rounded barrel, higher in the hind than the fore hand were the characteristics which mainly distinguished the Suffolk. The predominant color—in fact, the almost invariable color—of the Suffolk has always been chestnut.

As much as a century and a half ago the Suffolk attracted attention for his draft qualities, and many exhibitions of his strength were staged in his native county. These exhibitions not only involved hauling loads, but matches between individual horses and teams to pull against each other, in the manner of the tug of war between athletic teams.

Another and rather unusual method of reaching a determination of courage and strength was to hitch individual horses or teams to an immovable object, such as a tree, and award the palm of merit to the animals which made the greatest number of efforts by throwing themselves into the collar and pulling with all their strength at the word of command.

One of the most interesting among the older English writers on the horse tells of the sporting instinct which these contests aroused, and that on one occasion 1,500 guineas were wagered on the result, when 15 horses were attached to an equal number on the other side, in a tug of war, to see which could move or outpull the other.

Just when and where the Suffolk originated is not a matter of authentic record. It is well known, however, that for a long time before the Suffolk Punch was recognized in England as a separate breed, the French had bred a superior type of large animals, known as Norman horses, which were generally of chestnut color, with white legs and blazed faces. It is possible some of them had crossed the Channel and become segregated in Suffolk. On the other hand, the Suffolk Punch might have been created in England as a distinct breed through the medium of crosses similar to those that took place when the Norman was developed in France.

Every well-bred Suffolk horse of to-day is descended from a nameless stallion of the old breed, foaled in 1768 and owned by a Mr. Crisp, of Ufford, near Woodbridge. He was a bright-colored chestnut 15½ hands in height. About 1773 fresh blood was introduced through a trotting stallion, short-legged and of chestnut color, which blended thoroughly, with the result that, while not greatly altering the breed, there was an improvement in appearance and action.

In the early part of the 19th century another foreign stallion, also of chestnut color, was introduced, the new cross adding a little more size.

Suffolk breeders object to white stockings. One of the conditions of entry in the Suffolk Stud Book is that "no horse otherwise than a chestnut color shall be admitted, but white or silver hairs well blended with chestnut shall not be held to be ground of objection, provided the quantity does not amount to a decided roan."

In his investigations of color in horses, Professor Anderson, of the Kentucky Experiment Station, found that chestnut color is recessive to all other colors, and that a chestnut horse can produce only one kind of reproductive cells as to color. Consequently, when a chestnut mare is bred to a chestnut stallion the foal will always be chestnut in color, regardless of the ancestry. It was thus easy to fix the color in the Suffolk breed of horses. When breeding horses of other colors, it is not possible to predict with certainty what the resultant color will be.

The Suffolk is native to Suffolk County, in eastern England, and production of the breed is confined almost entirely to that and adjoining counties. The Suffolk is not bred in competition with other heavy breeds for work in cities, but ranks high among farmers in England, as capable of doing a large amount of work on less feed and for longer periods than any of the other heavy draft horses.

While occasionally a stallion may weigh 2,000 pounds, such weight is not characteristic of the breed. In general, the Suffolk is smaller than the Shire, Clydesdale, Percheron, and others of the heavy draft breeds. The Suffolk has a deep and wide body and the ribs have a pronounced spring, giving the body a round and full appearance. The croup is straight, the sloping croup being rarely found in this breed. The quarters are round and well muscled. The legs are short and free from the long hair or feather characteristic of the Shires.

The Suffolk is active, usually of a good disposition, and is rated as an easy keeper. The distinguishing characteristic of this breed is

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GERMAN COACH HORSE

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AMERICAN SADDLE HORSE

the invariable chestnut color, varying from light to dark.

Suffolks were first imported to America in the early eighties, and while continuing to come in small numbers, they have never gained a strong foothold here. They are not bred in large numbers in England and the home demand leaves only a small surplus for export. Their lack of size as compared with other draft breeds has deprived them of favor, but the American Suffolk Horse Association finds sufficient interest to maintain a Suffolk Horse Stud Book, which contains the registration of 1,356 animals to March 4, 1922.

There has been some crossing of Suffolk stallions on native mares in this country, but not of sufficient extent to create an appreciable number of half-breds or to enable a fair judgment of their value in comparison with other half-bred draft horses.

THE CLYDESDALE

(*For illustration see Color Plate XV*)

The Clydesdale originated and has been developed in Scotland, and is practically the only draft horse found in that country. The early history of the breed is obscure, but it probably contains the blood of both the English draft horse and of the old heavy Flemish horse. For many years, however, the Clydesdale has been bred pure, and since 1878 has been registered with the Clydesdale Horse Society of Great Britain and Ireland.

The Clydesdale is not as heavy as either the Belgian or the Shire and, as a class, will not equal the Percheron in weight. The Clydesdale is more rangy and lacks the width and compactness of the other breeds mentioned.

The Scotch breeders have paid particular attention to legs, pasterns, and feet, but have placed less emphasis on weight than has been the case in other heavy breeds. Mature Clydesdale stallions in this country will probably weigh from 1,700 to 1,900 pounds, when in fair condition, and average about 16¾ hands in height. The mares will probably average from 1,600 to 1,800 pounds in weight and about 16 hands in height.

No other draft breed equals the Clydesdale in style and action. The prompt walk, a good snappy stride, and a sharp trot, with hocks well flexed and carried close together, are characteristic of this breed. Good, clean, flat bone; well-set, fairly long and sloping pasterns, and a moderate amount of fine feather or long hair at the rear of the legs below the knees and hocks are also characteristic features.

The colors most commonly met with are bay and brown, with white markings, but blacks, grays, chestnuts, and roans are occasionally seen. The white markings are characteristic, and it is the exception to see a bay or brown Clydesdale without a white face and considerable white about the fetlocks and legs.

Americans, as a rule, do not fancy a horse with a white face and legs, nor is the feather or long hair about the fetlocks popular, because of the difficulty in keeping the legs and feet free from mud and snow.

It is not always easy to differentiate between Clydesdales and Shires, but on the whole the breeds are quite distinct. The Clydesdale is not as heavy-bodied as the Shire and has more refinement. The feather is more silky and less abundant in the Clydesdale than in the Shire.

The American Clydesdale Association was organized in 1879, and up to January, 1922, a total of 21,000 animals had been registered. The distribution of the Clydesdale in this country is quite general in the North, but they are seldom seen in the South. They are mainly found in Iowa, Illinois, Wisconsin, Minnesota, and the Dakotas.

Clydesdale geldings are popular for use in cities, where draft horses with style, quick action, and a good, long stride are desired. Many excellent half-breds have been produced by mating Clydesdale stallions with selected native mares. While lacking the weight necessary for the heaviest work, they are just right for medium-draft work at the walk and trot.

In numbers among the pure-breds in America, the Clydesdales rank fourth on the list, but on January 1, 1920, there were only 4,248, as compared to 70,613 Percherons and 10,838 Belgians. This shows a decided preference for the Percherons, but it should be remembered that the number of Clydesdales available for sale in Scotland is very small compared to the number of Percherons in France. The breeding of Percherons has been going on in America very consistently and for a considerable period, so that there is no longer dependence upon France for breeding stock.

THE BELGIAN

(*For illustration see Color Plate XVI*)

The Belgian draft horse originated and has been developed in Belgium, and is the only breed of horses which is bred to any extent in that country.

There were originally three types of draft horses in Belgium: the Flemish, the largest, produced nearest the coast; the Brabançon, an intermediate type, bred farther inland, and the Ardennaise, a small, rapid draft horse, similar to the French horse of that name, bred in the border districts. There has been more or less amalgamation of these three originally distinct types in the evolution of the existing Belgian draft horse.

Belgium is a part of the original territory to which the old Flemish horse was indigenous, and it is clear that the Flemish stock was the foundation of the modern Belgian.

The Belgian divides honors with the Shire as being the heaviest of any of the draft breeds. Stallions weighing a ton or more are comparatively common. In height, mature stallions average over 16¼ hands, and mature mares above 16 hands. In conformation, they are the most compact of any breed, the bodies being short, wide, and deep. The head is of medium size, the neck is short and heavily crested or arched; the chest is broad and deep; the back is short and well muscled over the loins; the croup is somewhat drooping or steep, and the quarters are full and heavily muscled. The legs

are short and free from the long hair or feather characteristic of the Clydesdale and Shire.

The Belgian is less active than the Clydesdale or Percheron, but in temperament is docile and easily handled. He is a good feeder and is easily kept in condition.

The Belgian, according to numbers in America, ranks second in favor to the Percheron, but there are certain deficiencies which will probably prevent his ever becoming a serious rival of the latter, which outnumbers him seven to one.

Many Belgians have short and heavy necks, drooping croup, a roughness about the hocks, and short and straight pasterns. Notwithstanding this lack of quality, the Belgian has made much progress in America during the past 20 years, and where selected Belgian stallions have been mated with rangy American mares, the results have been very satisfactory.

The Belgian Draft Horse Society was not organized until 1886. At the annual horse show, 1914, held by the society, the number of entries exceeded 1,000, probably the largest number of a single breed entered at any show in the world. At the annual show held in 1919, the number of entries exceeded 800, notwithstanding the devastation of four years of war.

The Belgian Government's interest is manifested by annual awards of prizes and subsidies to the best animals in the various provinces. Stallions which stand for public service must be approved by a commission appointed by the government.

The American Association of Importers and Breeders of Belgian Draft Horses was organized in 1887, and up to March 1, 1921, a total of 12,708 stallions and 9,203 mares had been registered. While the old Flemish horse undoubtedly had an influence in England, and perhaps in France, in the long ago, it is not easy to trace definitely. Just what the effect will be in America can hardly be predicated upon the history of any draft breeds as yet developed.

Whether the numerous draft breeds now maintaining separate registration in America will continue indefinitely is a matter of conjecture. If a composite draft horse shall arise in America within a century or two, the old stud books, if properly preserved, should throw more light upon its history than exists now of any of the present well-defined and separate breeds. Any of the existing types, taken in connection with mules, should fill all the needs of America, but, as with cattle, each breeder sets store by his favorite breed and has his following.

THE SHIRE

(*For illustration see Color Plate XVII*)

Whatever mixture of blood may have found its way into the Shire horse, as known to-day, its origin and development pertain strictly to England. The Shire horse-breeders of England organized in 1878 as the English Cart Horse Society, but a few years later the name was changed to the Shire Horse Society, and to the world this fine, useful great horse is now known as the Shire.

The history of this animal has long aroused the interest of British writers, and, as usual, whenever the history of any type of horse runs back beyond a century or two, lack of established and veracious records leaves wide open the doors of speculation.

In this case, however, it is not necessary to draw heavily upon the imagination to connect the modern Shire with the Great Horse of England, which was developed during the period when the heavily armored knights rode forth to battle for king and country and betimes to enforce their views of religion upon unbelievers in general and Mohammedans in particular.

The general use of saddle horses in England, according to the best authorities, did not obtain until about the seventh century, although horses were employed by the natives of that country before the Christian Era. The battle chariots, used to convey quickly to strategic points the men who fought on foot, were encountered by Roman legions under Cæsar when he invaded England, in the year 55 B. C.

The absence of good roads and the crudeness of the heavy chariots make it certain that the war horses of the English were possessed of both size and stamina as well as activity.

While the art of fighting as cavalry was of very slow development in England, horses were used to convey picked troops of heavy build, encased in armor, from place to place, as well as in battle, and this demanded a powerful horse.

The use of some kind of armor was universal for 500 or 600 years before gunpowder for military purposes was adopted by fighting nations. Mail or chain armor was in use during the Crusades and continued until displaced by the heavier plate armor, which demanded a large, heavy horse.

Out of these needs of the mounted services came the development of horses in several countries, which found later their high destiny in civil work, when commerce and agriculture, followed by industrialism, came to occupy the attention of nations between ever-recurring wars.

It is well established that when laws were enacted regulating the breeding of large horses in England, importations of stallions of the heavy class were made from the Continent for the royal stud. These importations took place a century before coaches were introduced in England, but it seems reasonable to conclude that the heavy horses were used for many draft purposes as well as for the saddle, and that upon the abandonment of armor, lighter horses came into use for riding, and the heavy animals were then relegated to their more natural and proper employment, in the cart, the plow, and for hauling heavy ship and other timbers.

The Shire, as known to-day, is a much larger horse than his forebear, used by the mounted warriors of old. The Shire is a massive horse, with a wide, deep, and long body, and is equaled in weight only by the Belgian. A Shire stallion in fair condition should weigh 2,000 pounds or more and the mares should average about 1,800 pounds. The Shire stallions average about 17 hands in height, many going above that, while the mares usually exceed 16 hands. The Shire

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SUFFOLK

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CLYDESDALE

is a big, rangy horse, and on the average is taller than any other breed. It is characterized by heavy bone, heavily feathered legs, sluggish temperament, and prevalence of white stockings.

The Shire lacks the alertness and general refinement of the Percheron, deficiencies which have made it less popular in America than the French horse. The breed, however, has met with much favor in the Central West, for the Shire is a truly great horse, of tremendous power.

Unquestionably, the existence of large quantities of feather or hair about the fetlocks has cost the Shire deserved favor, but this does not count so heavily against him in city work. Here, however, the Shire and all other heavy draft horses have encountered serious competition in the rapid development of motor trucks.

Just what will happen when gasoline mounts to prohibitive cost remains for the future to disclose, but it would be an international misfortune should conditions result in making the breeding of the splendid Shire horse unprofitable.

In popularity in America, the Shire ranks third among the draft breeds on farms, according to the last census of pure-bred animals, but in numbers comprises only 5,617 as compared to 10,838 Belgian and 70,613 Percherons.

The American Shire Horse Association has recorded over 19,380 animals since its organization, in 1885. The Shire horses are seldom used in the Southern States, but have met with favor in California, Oregon, and Washington.

Power and not speed is desired in the draft horse, for the hauling of heavy loads is done at a walk. These conditions demand a compact, short-legged horse, of sufficient weight to enable him to move the load by throwing himself in the collar. With great height there must go proportionate development of size, weight, and strength, and these points are all characteristic of the Shire.

While automobile trucks have been undergoing improvement in many ways in recent years, there is yet a possibility that in some fields the Shire and other heavy draft horses may prove more economical. A Shire colt may begin work, adjusted to his strength, at two or three years of age on the breeding farm, and be sold at four or five for heavier hauling. With care and proper feeding, he should give good service until 15 to 18 years of age or longer. The original investment in a motor truck will be six times greater than the cost of a Shire and the truck will go on the junk pile about the time the horse is reaching his greatest period of usefulness.

THE PERCHERON

(*For illustration see Color Plate XVIII*)

The Percheron horse is the product of several centuries of careful breeding in a district of France about one-fifteenth the size of the State of Iowa. In the days when France was still much in forest, horses were being raised in the Perche district, and infusions of blood there resulted, as in all other regions, from home-coming warriors bringing horses taken from the enemy.

When Charles Martel defeated the Saracens at Tours and Poitiers, 732 A. D., vast numbers of horses were taken and distributed throughout France, and doubtless they exercised considerable influence on the horses of all the breeding districts.

The Crusaders, also, were credited, several hundred years later, with bringing home choice horses, but they could not have been of the class needed to build up the now famous horses of the Perche. In fact, the demands of the Crusaders and of the knights in general were for a horse of martial bearing, capable of carrying a man in armor. The total weight of knight and armor was very great, although many specimens of armor used by Crusaders and others, still preserved in Europe, indicate that the knights, who were always made to appear very large in old paintings and prints, were inferior in size to modern athletic, well set up soldiers.

Without entering into the many speculations as to the origin of the Percheron, it is well established that the district supplied for a long time the heavy post horses, capable of pulling the old-style stage or diligence at a smart gait, and a slightly lighter class of horses for use of the army, and that the gradual change to production of the heavy draft horse began about a century ago.

Following close upon the development of the Percheron as a heavy draft horse in France, importations to America began. During the Civil War there were many half-breds in Ohio, and they were much sought after for army use.

The introduction of the heavy horses was very gradual, and it was not until after the Civil War that any were found west of Ohio, but by 1870 the center of interest in the Percheron was in Illinois. The results of the Percheron cross on native mares was very marked. That the popularity of the breed exceeded that of all other heavy horses combined is attested by the census of pure-breds now in America, from which splendid types of the large horse are being regularly added to the list.

As stated elsewhere, the number of imported Percherons in America now exceeds the total of all other imported heavy draft horses combined and the importations of the best to be had in France continue.

The Percheron is not so large a horse as either the Belgian or the Shire, but as a general rule is heavier than the Clydesdale. Some of the stallions attain a height of 17 hands, but a preference exists for the short-legged, compact form. It is not uncommon for the modern Percheron colt to weigh a ton at three and sometimes even at two years of age.

The prevailing and preferred colors of the Percheron are black and gray, although bays, browns, chestnuts, and roans are sometimes seen. About 90 per cent, however, are either black or gray. Grade Percherons of these colors, when of the right conformation, are always in demand and easily marketed.

The discrimination of buyers has done much to educate the farmers as to the type of mare to be mated with the Percheron. In the early years of Percheron development many mistakes were made. The writer was at that time buying horses for the Army and took occasion to comment officially upon the large number of young, rangy, iron-gray, half-bred Percherons, with tails set low, undersized bodies, long legs, and big feet. They were clumsy in harness and unsuitable for cavalry service.

Fair criticism and unsalability soon corrected the matter. It only required the use of better judgment in selecting mares. The popularity of the Percheron grades is readily comprehended when it is considered that the last volume of the Percheron Society of America's Stud Book, issued in 1921, shows that 160,000 pure-bred animals had been accepted for registration up to that time.

More refinement is observed about the head and neck of the Percheron than in any of the other draft breeds. The head is clean cut and of medium size, and the neck rather short and well crested. The chest is deep and broad, the back is short, the loins smooth and well muscled. The croup is wide and in some cases sloping, which latter is not a desirable quality. The legs and feet are generally good and clean, without the hair or feather characteristic of the Clydesdale and Shire.

In action the Percheron is good at both the walk and trot. His action at the trot is characterized by a snap not displayed by any other draft breed. Without doubt, this is one of the qualities which accounts for his popularity, but the absence of the hairy legs is a popular factor in the corn country, where the break-up of winter is usually followed by long periods of melting snow and slush.

The tribulations of the farmer since the World War have been great, but are not to be compared to the distress of the breeders for years following the panic of 1893, when many aggregations of pure-bred horses were dispersed at a mere fraction of their cost. But the Percheron has come to stay and for the past 20 years he has made his way into hearts and stables all over the West.

When the World War demand for horses sent the army buyers scurrying to America, they were more than delighted to find, at reasonable prices, large numbers of high-grade Percherons that met in every way their requirements as transport and artillery horses. A team of well-matched Percherons will attract admiration in any assemblage of the world's best horses.

THE THOROUGHBRED

(For illustration see Color Plate XIX)

Thoroughbred is the name applied to the breed of running horses used for racing on the turf or track. In England races are run over straight courses, usually on turf, while in America tracks are nearly all elliptical in shape, the surface being cleared of all turf and stones and made as smooth as possible, to enable horses to put forth their best efforts. The difference between straight and elliptical courses must be considered in comparing time made on the two tracks.

There is a marked distinction between pure-bred and Thoroughbred. The first may refer to any horse qualified for registration in the stud book of his type; the second relates only to the breed of running horses which have descended in direct line from a particular group admitted to registration as Thoroughbreds when it became assured that a fixed type had been created.

Trials of speed had taken place between horses from the earliest recorded history, but the foundation of the Thoroughbred stock traces back only to the reign of Charles II, when a number of Barb mares were imported into England for the royal stables during the period from 1660 to 1685.

It was on this and other selected stock that dependence was had when the Byerly Turk, imported in 1689; the Darley Arabian, imported in 1706, and the Godolphin Barb, imported in 1724, were established at the head of the racing studs of England and laid the foundation of the Thoroughbred.

The early race horses resembled their sires in size, few of them exceeding 14½ hands in height. The three sires named were all less than 14½ hands, but gradually larger horses were produced and greater speed resulted.

It has been estimated that race horses increased in height an average of one inch each 25 years from 1700 to 1850.

Along with increased height went size and stamina, for very early in the racing calendar races of six miles were not uncommon and four miles was the usual distance, frequently run in heats, with weights prescribed by law at from ten to twelve stone, in accordance with age, the stone being rated at 14 pounds.

About a hundred years ago the introduction of shorter races and lighter weights began, and this change gradually affected the breeding, which tended toward the creation of an animal qualified to win at short distances, without regard to the strength and stamina demanded for long distance and heat races. Rarely is a horse now called upon to run more than a single heat of one and a half miles.

Coming down the years, from the earliest recorded history, the horse is encountered in song and story; yet when we come to appraise, at their relative value, the Persian, the Assyrian, the Macedonian, the Libyan, the Egyptian, the Arabian, the Barb, and other ancient breeds, we find ourselves embarked upon a sea of romance.

There seems to be absolutely no recorded history of any particular line of descent of horses that antedates the Thoroughbred, which has been maintained through the past two centuries. The most aristocratic of the Arabians have been kept unsullied in purity, but individual lineage has not been preserved, nor is it deemed necessary by the Arab tribes.

In the breeding of Thoroughbreds the most rigid selection is practiced, racing performance being the only standard. Thoroughbred stallions are used, however, to cross on selected

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BELGIAN

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SHIRE

mares to produce hunters, remounts for cavalry, and polo ponies. After 200 years of experience, breeders have observed no decadence in the blood, and there is no suggestion of possible improvement of the Thoroughbred by any further cross.

The pure Arabian is admitted to Thoroughbred registry; but while his prepotency in the beginning was highly important in fixing the Thoroughbred type, experiments in crossing on Thoroughbred mares in recent years have not resulted favorably, so far as improvement of racing qualities is concerned.

The Thoroughbred is the oldest of the improved breeds of horses known to the world to-day, and was the first to be registered in a stud book of its own.

The breed is characterized by extreme refinement of form and appearance, the colorings following quite uniformly without any of the tendency to lines, stripes, or piebald spots which characterize the horse in his feral state.

The intensive study incident to mating of Thoroughbreds to obtain speed has led to consideration of speed records with regard to sex and color. Taking a famous Thoroughbred stallion, St. Simon, as an example, it was observed that his grandsons and granddaughters of chestnut color were inferior in speed records to their bay and brown brothers and sisters. It was further shown that the brown fillies were of superior racing ability to the brown colts, as well as to the bay colts and fillies.

Of course, if any such conditions were of general application, it would be necessary to call in the services of the handicapper, or the owners of the brown fillies would make the racing of all others unprofitable.

There is no royal road to success in racing except to follow the lines of breeding in which the great race horses have been produced. Even then the door of disappointment is always ajar, though the greatest chances of success lie in following the rule that like produces like.

Some years ago a colt was produced in Tennessee, and under the name of Luke Blackburn became famous from his first appearance on the track. At the next annual sale of yearlings a full brother to Luke Blackburn was among those offered. When the bidding had reached the then unheard-of price of $7,000, the master of Belle Meade arose and asked to be allowed to withdraw the colt, because no untried yearling was worth that much, and disappointment in event of any failure would react on the breeding industry. The bidder insisted on his rights and got the colt, which never won a race.

Values have changed in recent years, and in 1921, at the annual sale at Saratoga, $21,000 was paid for a bay colt by Sweep-Ballet Girl. The colt is a full brother to The Porter and other race horses of acknowledged merit. The colt was not run as a two-year-old, but if he develops the speed which his breeding indicates, he should be a strong candidate in his three-year-old form.

The highest price for a yearling at the last sale, in 1922, was $19,000, paid for a chestnut colt by Trap Rock, sire of many winners, whose brother, Tracery, an American horse, winner of the St. Leger in England, was sold for $265,000, the highest price ever paid for any horse.

In 1920 a highborn colt was sold for $72,500, which is the highest ever paid for a yearling. Prince Palatine brought the highest price ever paid for an English horse, $209,000.

The superhorse of his generation is Man-of-War. The story of his purchase is of interest. When Man-of-War was a yearling at the nursery farm of Mr. August Belmont, in Kentucky, the lot of yearlings was offered to Mr. Riddle, who sent his trainers to look them over.

They learned that one yearling had been set aside for Mr. Belmont. It was also learned that a full sister of the yearling, the first foal of his dam, Mahubah, had been tried out by Mr. Belmont's trainer, and made such fast time it was believed to be a mistake. Another trial was had and the proof of speed was accepted.

This impressed Mr. Riddle, so that when he found Man-of-War among the yearlings at Saratoga for the annual sale, he examined him and determined upon adding him to his stable.

From the first, Man-of-War showed great promise and his consistent development of speed continued until in his three-year-old form he became the most famous horse in the country and justified his reputation in every race in which entered. He was never required fully to extend himself. He not only had speed, but was considered able to go any racing distance.

His remarkable freedom from sickness and injury continued until his retirement to the stud, where he should fulfill his destiny as one in whose veins flows the best race horse blood of the world. Man-of-War's winnings while racing amounted to $249,465.

In the early years of racing it was the custom to use blankets in training and to sweat horses unmercifully to remove the fat. When it was shown that a horse could be trained in flesh, without all the weakening incident to heavy sweating, it was abandoned.

The next material change in racing came with the adoption of the present jockey seat, in which the rider is crouched in short stirrups over the horse's withers. Instantaneous photography seems to show that the motion of the horse is less interfered with by the rider in the new seat than in the old, and that slightly better time can thus be made.

THE HUNTER

The Hunter is not a distinct breed of horse, but it is generally accepted, at the present time, that the type of animal required to carry weight across country, to negotiate satisfactorily the fences, ditches, streams, and other obstacles encountered, and to keep up with the hounds, can only be derived from mating animals of high quality with much infusion of Thoroughbred blood.

Hunting is one of the oldest diversions of

mankind, and the term covers the chase in all its forms, although seldom used now except in relation to fox hunting.

The ancients hunted the boar, the wild ass, the wild horse, the deer, the antelope, and all the game animals which formerly ranged the regions now occupied by man, who in his civilization decreed extinction to everything which did not lend itself readily to his change of habits from that of nomadic hunter to one of settled abode incident to the pursuit of agriculture.

While the ancients gave first consideration to horses for use in war, they also had definite ideas of the qualities required in the arena and the hunting field. As far back as the second century after Christ, one of the old writers, in a treatise on hunting, said that while each country had its own breed, he regarded as the most worthy at that period the Etruscan, Sicilian, Cretan, Mazicean, Achaean, Cappadocian, Mauritanian, Scythian, Magnesian, Epeian, Ionian, Armenian, Libyan, Thracian, and Eremian. At this time it is difficult even to locate, geographically, some of the breeds named, but the Libyan seems at that distant period to have been already recognized as of high quality, and it is to the horses of northern Africa that we pay homage as the progenitors of much that is best in all our modern breeds of horses.

While England has long maintained the honor of leadership in the hunting field, the breeding of hunters seems to have been an ancient occupation in Ireland, which country continues now to be the source of supply of the highest grade of hunters known to the world.

From a very early period Ireland obtained horses from the Mediterranean and continental traders, many of them of undoubted Libyan descent. There was already a good foundation stock of mares when the Byerly Turk arrived in Ireland in the latter part of the seventeenth century, and they responded perfectly to the new infusion of blood by the creation of a splendid type of race horses.

The mating of Irish Thoroughbreds with the Irish cart mares determined the character and quality of the hunter, which has been a national asset for two centuries, the supply never being equal to the demand.

The Irish hunters of highest quality are produced on grass lands with underlying limestone. The best of Thoroughbreds and Hunters in America are bred on similar lands, and the nearer they approach in big and strong bone to the Irish horses, the more highly prized they are.

Hunters are classified according to the weight they are expected to carry, varying from light weight, capable of carrying riders of from 135 to 165 pounds; middle weight, from 165 to 190 pounds, and heavy weight, up to 190 pounds and over. They are also classified as green or qualified, the latter only after having been hunted one season with a pack recognized by the United Hunts and Steeplechase Association.

To be a satisfactory hunter, a horse must be a consistent jumper of obstacles, up to five feet, encountered in cross-country runs. A horse may be capable of winning a high-jumping contest and still be far from safe across country.

Those who ride for exercise, especially those who would reduce in weight, are always on the lookout for high-grade hunters, even though they may never follow the hounds. There are comparatively few packs of hounds in America, but an ever-increasing number of both men and women who have come to appreciate the pleasures and health-giving qualities of horseback riding.

It adds immensely to the pleasure of horseback riding if one is mounted upon a trained hunter equal to negotiating an occasional ditch, stream, or fallen tree, such as are encountered whenever one leaves the beaten tracks.

If there is anything which gives greater contentment than possession of hunters able to go the pace and take the jumps as they come, the writer has never heard of it.

THE STANDARD BRED HORSE

(*For illustration see Color Plate XX*)

The Standard Bred is an American breed, frequently referred to as the American Trotting Horse. As both trotting and pacing horses are registered in the same stud book, Standard Bred seems the preferable designation. The twenty-one volumes of the stud book which have been issued to date contain the registration of 65,000 stallions and 200,000 mares.

Messenger, an imported Thoroughbred stallion, and imported Bellfounder, a Norfolk trotter, registered in the English Hackney Stud Book, are credited as largely responsible for the foundation of this breed. Rysdyk's Hambletonian, a stallion to which a majority of Standard Breds trace, carried the blood of both. Some families of Standard Breds have produced a large proportion of pacers, while many individuals have shown speed at both the trot and pace.

After the American Trotting Horse appeared to have established his right to a stud book because of the consistent performance of horses bred in trotting lines, there was a tremendous controversy as to the descent of both stallions and mares involved in the creation of the foundation stock. Messenger was a gray stallion, known not unfavorably on the English turf, but with no great races to his credit. He was imported to America in 1788 for the purpose of breeding runners, and some of his get were good race horses, one of his running grandsons being American Eclipse.

There were no tracks devoted to trotting races until many years after the coming of Messenger to America. When interest was first manifested in trotting horses, they were sent over the courses under the saddle.

It was about 25 years after the arrival of Messenger before trotting races began to attract serious attention, and then distance was of as much consequence as time.

Both running and trotting races in all the earlier years were real trials of strength and stamina, for they were for long distances and frequently were heat races, the best two in three or three in five, each heat being of two, three, and sometimes four miles. It demanded bottom and courage to go through such contests.

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PERCHERON

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THOROUGHBRED: MAN-OF-WAR

For half a century the evolution of the trotting family went on, and a commingling of blood from many sources gradually crystallized into one line capable of breeding true to type and enabling the patrons and admirers to agree upon a system of registration and the adoption of a stud book.

It was a long time before the old slogan of "2.30 on the shell road" ceased to be a dream, and the time was gradually lowered until Flora Temple trotted a mile in 1859 in 2.19¾. This remained the record until after the Civil War, when a resumption of interest in racing brought together Ethan Allen and running mate, hitched double to a wagon, against Dexter in a sulky, at the Fashion Course on Long Island, in 1867. The writer saw Dexter on that occasion lower the trotting record to 2.17¼. Over the same course, six years previously, July 25, 1861, Flora Temple had beaten Ethan Allen and running mate, distancing the team in the second heat. The time was 2.21¼ for the first heat and 2.20½ for the second.

Dexter held the record for four years, when the results of breeding along trotting lines became more apparent in the rapid lowering of the mile record by some of the superhorses of their day—Goldsmith Maid, Maud S., Nancy Hanks, and finally Lou Dillon, whose record of a mile in 1.58½, in 1903, amazed the world.

While breeding had been directed along lines to produce great speed on the track, the characteristics of the new horse were gradually fixed so as to produce a useful horse, since only a few could be counted upon as record-breakers. For the large number which did not inherit speed enough for the track, a market was found among admirers of the light buggy horse. Half-breds showing some quality and style were always in demand as roadsters and for light wagon and farm work.

The type of Standard Bred fixed upon by breeders contemplates a horse from 15 to 16 hands in height, weighing from 1,000 to 1,200 pounds when in driving condition. Horses of this breed are heavier in proportion to their height than the Thoroughbreds and do not show such high quality of blood lines, the ears, head, and bone particularly being of coarser type.

The trotters attain speed through ability to extend themselves into long strides, repeated rapidly. They are enabled to accomplish this by reason of the greater proportionate length of forearm and lower thigh which they possess. Their muscles are long, narrow, and bandlike, with capacity for rapid contraction in an extreme degree. The running horse attains his speed by an entirely different manner of propulsion.

In creating and fixing the type known as the Thoroughbred, there was never any experimentation involving any gait except the run or extended gallop. It is astonishing how blood of running, trotting, and pacing horses is mingled in the Standard Bred.

In developing for speed as the primary qualification, there has been some sacrifice of conformation, if the type may be judged by some of its speediest individuals, but there remains sufficient of the blood of the old-time long-distance trotting horse to supply half-breds of a most useful kind for the mounted services of the Army and for certain kinds of farm work.

It is probable that the coming of the automobile has already signaled the decadence of the much-beloved long-distance road horse, but the craze for short-distance races on the trotting circuits and at the fairs had its influence in depressing the spirits of those who had followed with pride the development of the vigorous horses, equal to the effort of long-distance drives and races with two-, three-, and four-mile heats.

The present generation may not see a revival of public interest in the Standard Bred horse. Men who never had the courage and other qualifications to engage in the very human pleasure of driving a fine horse do not hesitate to speed up automobiles beyond the limit of safety to themselves and the public, or to mortgage their all for the possession of the latest model.

THE MORGAN HORSE

(For illustration see Color Plate XXI)

A hundred years ago a tavern-keeper in Massachusetts moved to Vermont, taking with him a wonderful little stallion, which has perpetuated and made famous the name of his master, Justin Morgan. The breeding of this horse remains one of the unsolved mysteries, but his prepotency in perpetuating his own excellent qualities has given to the world a new breed, long and favorably known as Morgans. Ability to transmit his qualities descended to his sons and fixed the type to which the Government in later years has rigidly adhered.

In the effort to find a recognized aristocratic ancestry for Justin Morgan, he has been traced to mythical forebears, but he needed no bolstering up of the past, for his reputation had already been made by what he had transmitted.

The type of horse which has descended from Justin Morgan bears little resemblance to the Barb or Arabian and none at all to the Thoroughbred, nor are the Morgan gaits typical of any of the families named.

Justin Morgan was not a large horse, being only 14 hands in height and weighing less than 1,000 pounds. He was of dark-bay color, with black mane, tail, and legs. He had a short back, with long and sloping shoulders. His body was round, close-ribbed, with a deep and wide chest. His legs were short and extremely well supplied with hard muscles. He had long hair about the fetlocks and his feet were small and well shaped.

This founder of a most useful breed was entered in many contests in Vermont and won in both trotting and running races. There is nothing to show that he was matched in running races, however, with any of the blue-blooded racing stock which existed abundantly in America during his lifetime; nor was the original Morgan especially noted for speed as a trotter—a quality, however, which was materially developed in some of his descendants.

Being of no established breed then registered, it is not surprising that the mares selected for mating with Justin Morgan cannot

be traced with any degree of certainty, although he continued in the stud for more than 20 years, long after his sons and daughters had added many laurels to his early fame.

The second generation of Morgans bred true to type, but many were of slightly increased height and weight. This change was more marked in the third generation; but the Morgan horse has ever been characterized by his staying qualities and consistent performance rather than by size and fast records. In fact, the effort to cross-breed for speed was a serious blow to the Morgan stock, for, while producing a few superior animals, the general run of the breed, not fast enough for racing, were overlooked, and America came near seeing the end of a most useful type of horse which had been originated in the country.

Probably no horse ever received more attention from the public in his day than Ethan Allen, a son of Black Hawk, he by Sherman Morgan, the son of the original Justin Morgan. It was the good fortune of the writer, when a boy, to witness a great race by Ethan Allen.

Having been brought up in a blue-grass region, where only the Thoroughbred was held in esteem for racing, my interest had never been aroused in trotting horses. My father informed me that the race scheduled for June 21, 1867, between Ethan Allen, with a running mate to pull the wagon, and Dexter would be a historic contest and that I might attend as a special favor. Ethan Allen and mate won in three straight heats, the time recorded being 2.15, 2.16, and 2.19. Dexter made a great race, but the running mate with his opponent was a serious handicap.

The Morgans, while not abundant in the country, are well distributed at the present time and are so much appreciated that there is no probability of their being allowed to lose their identity, especially since the Government has seriously interested itself in their perpetuation.

The Morgans have gradually increased in height and very slightly in weight since the breed first came into notice. They now average about 15 hands and weigh about 1,000 pounds, sometimes, however, going considerably beyond that, to 16 hands and 1,200 pounds.

The Morgans are usually chestnut, brown, bay, or black in color, white marks not being common. They have always been admired for their useful qualities rather than for speed.

The breed is noted for smooth lines, stylish action, endurance, easy-keeping qualities, and docility. Their small ears, fine eyes, and crested necks give them an attractive appearance. They have a fine, natural knee action, which some of them have transmitted to standard-bred and saddle-horse families to their manifest advantage.

That the Morgans have lost none of their fine qualities is attested by the performances in the annual endurance rides conducted in recent years under the patronage of a number of associations and lovers of the horse.

The last endurance ride was held during the autumn of 1922. Gladstone, a registered Morgan gelding, won second place under conditions which were rather grueling. Gladstone's half-brother is a veteran of three previous endurance rides. Gladstone was sired by General Gates, for several years at the head of the Government Morgan stud.

Gladstone was foaled in 1913 and remained at the Government farm until he was four years old. He was then sent to the Government experimental farm in Maryland, where he was used in the station wagon, making many trips each day. With a record for reliable work, he was selected as one of the pair used in the carriage of the Secretary of Agriculture in Washington. He continued this work for several years.

He was returned to the Government horse farm in June, 1922, and prepared to take part in the endurance ride. He was worked during the haying season, after which he was used under the saddle until the date of the endurance ride.

Many of the entries which exceeded Gladstone by 200 pounds were among those compelled to fall out. Gladstone finished the test in excellent condition, with the same score as accredited to the winner and only three points behind in time. The official record states regarding Gladstone: "Sound as when started."

When the sire of Gladstone and Castor died, the post-mortem examination showed only five lumbar vertebræ. Similar conditions have been found to exist after post-mortems in other cases. Should the existence of only five lumbar vertebræ be characteristic of all the Morgans, that would suggest descent from the Arabian (see text, page 496), but it would require remarkable prepotency of sire to fix an anatomical change of marked importance in the foals of such an assortment of mares as were known to have been bred to Justin Morgan and his sons.

POLO PONIES

(For illustration see Color Plate XXII)

Polo, in its simpler form as hockey on horseback, is an ancient game. The earliest recorded history of polo is found in Persia, from which country the game spread westward to Constantinople and to the east through Turkestan, Tibet, and China. In its earlier form, polo consisted of feats of horsemanship, involving skill with stick and ball. The Chinese game was played about the year 600 A. D. with a light wooden ball.

Grounds were first laid off in Persia in the sixteenth century, with limits of 300 by 170 yards, and the game was played by four on a side. This method was taken up in India, and the game consisted of dribbling the ball toward the goal.

The game was neglected for several centuries, but a revival began in Bengal in 1854, since which time it has never lost favor. Since it made its way into England and Ireland it has become a fast, hard-riding, hard-hitting contest with heavy sticks and large balls.

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STANDARD BRED HORSE

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MORGAN

The first match of modern polo, with large wooden balls, was played in England in 1871. The first organized modern polo tournament on record took place at Hurlingham, when the Royal Horse Guards won the first Champion Cup in 1876.

During the first 20 years of polo comparatively few clubs were organized, but since that time it has become a very popular game, so much so, in fact, that the younger element, especially of the Army, wonder how their forebears ever managed to get along without it. It is now played in all the larger garrisons around the world, and the number of civilian clubs is constantly increasing.

Polo gradually made its way to America, and has been pursued with such enthusiasm as to develop many excellent teams, some of which have competed with success in international matches. It is especially encouraged in the Army, and the excellent results, in the improvement of horsemanship alone, have justified the expenditure of time given up to the training for the game.

When polo was first taken up, it was thought any good, stout, active pony would do to follow a ball around, but as teamwork developed and rules based on experience were formulated, the possibilities of the game with fast, well-trained ponies became more apparent.

Interest was aroused in the breeding of ponies for the game, and in 1893 the Polo Pony Stud Book Society was formed in England with the avowed object of improving the breed of polo and riding ponies. The society holds shows and awards prizes for the various classes of riding ponies. The idea, of course, was to establish a breed of ponies of a definite type, toward which breeders might work in meeting the demand for polo mounts.

No pony could be admitted to registration until four years of age, nor any which exceeded 14½ hands in height.

It will be readily understood how very difficult the establishment of a breed of ponies became for use in a game which called for a perfect horse not exceeding 14½ hands in height. If it were merely to breed animals of that height fit for saddle purposes, there would be no need of looking further than the Arabians, Barbs, and other recognized families of small horses.

But the game of polo demands a strong, active, alert, fast horse, with approved stamina and ability to carry weight. There are not many feather-weights playing the game, and for those that constitute the majority of players, the very highest type of horses is demanded.

It was presumed that if Thoroughbreds of the proper size could be bred, that would solve the question; but here was encountered the historical fact that when the Thoroughbred first became an established breed the average height was about 14 hands, and that to increase this to the present average height of Thoroughbreds required a quarter of a century for each rise of one inch.

With good pastures, warm stables in winter, and abundance of grain, it would be quite impossible to breed downward. Even the Shetland and other well-established ponies increase in height as soon as brought under a stable routine which includes full feeding.

There remains always the chance in mating a Thoroughbred stallion with a mare of established pony lineage, provided the desirable polo qualities exist on both sides; but the resulting breed could hardly be expected to perpetuate itself with predominant polo tendencies within a reasonable number of generations. It would seem, therefore, that polo teams are reduced to the system in vogue in the professional baseball leagues, where recruits are obtained by scouts sent out to observe all those who seem to have the necessary qualifications for the game.

Polo was introduced in America in 1876 by the late James Gordon Bennett and, following the British custom, the game was played on ponies.

The game made its way on its merits, but it was not until 1890 that the American Polo Association was organized. As the number of players increased and the value of team play became more fully recognized, it was observed that, other things being equal, the team with the best ponies usually won.

This led to a nationwide search for ponies of sufficient speed, stamina, and adaptability to training, and when it became apparent that the speed of a Thoroughbred was necessary, there began a gradual increase in the size of horses allowed in the game, until now the animals are mainly Thoroughbreds of normal size. A small horse that meets all requirements is not shunned, but animals used in recent matches averaged from 15 hands to 15 hands 3 inches and occasionally one of 16 hands was played. When these animals are referred to as Polo Ponies it is merely an act of courtesy.

It was believed that a team with unlimited financial backing could always mount themselves in such form as to make success impossible for others, but this view has not been entirely sustained by experience. Then some inequalities have been adjusted by a system of handicapping.

Where teams are mounted on animals of the same type and size, there is every reason for playing the game, even though the animals are not up to the most desirable standard. Some of the best polo players of England and Ireland have had their first experience in India, where many small horses are used. Arabians, halfbreds, Australians, and native country ponies have all been used in matches, and the game is played the year round.

Some polo mounts have well-earned reputations as general utility horses in the game, but many others, like the players themselves, have personal equations which suggest their employment in particular positions. A polo player who owns all his mounts adjusts his purchases, among other things, to his own weight. Army players using Government mounts have to adjust the distribution of horses to meet the questions of weight, light or heavy hands, and horsemanship in general.

The army had the good fortune to win the Junior Championship in 1922. The average height of the horses played was about 15½ hands; average weight, about 975 pounds, in

playing condition. Eighteen out of the string of 25 were Thoroughbreds; some of the others were three-quarter bred. They were of the big barrel, short-legged, stocky kind, with short backs and straight legs. No crooked hocked, splay-footed, or calf-kneed horse was considered fit for the game.

More than half of the mounts were mares, and, in temperament, they were credited with being better adapted to the game than geldings. In the modern game of polo the horse must have strength, health, good wind, and some flesh, with racing speed.

For the present game at racing speed, shoeing has become all-important. The method used for the army horses is to put on the front feet handmade steel rim shoes set in well at the heels and not too long. For the hind feet, light Phœnix shoes No. 1 are used. The outside heel calk is round and blunt, about one-quarter of an inch high, while the inside calk is tapered thin and runs sloping toward the toe. The reason for this is that when the horse puts his foot down and stops straight on his haunches, the foot will not slip back, as it has the bearing of both calks. It will not slip forward, as it has full bearing on the outside calk, while the sharp inside calk cuts in enough to hold it. Then when the horse turns on his haunches the outside calk will hold the foot in place, while the inside heel slips over the grass and prevents the horse from twisting his ankle or hock.

THE MUSTANG

(For illustration see Color Plate XXIII)

After Columbus had made known his discovery of the New World, the Spaniards first established themselves in Santo Domingo, which formed the base of subsequent expeditions to Cuba, Mexico, Yucatan, South America, and Florida.

Horses were brought to the islands in small numbers at each voyage, but gradually the aggregate was sufficient to admit of carrying forward to the mainland mounts for the more important and responsible of the explorers.

Cortez took with him 16 horses, and his comrade, Bernal Diaz del Castillo, who preserved for posterity an account of the Conquest of Mexico, wrote out a minute description of each of the animals, comprising 11 stallions and 5 mares. This document is so little known that it is deemed worth while to present it in translation:

"Captain Cortez, a light chestnut stallion, which presently died in San Juan de Ulúa.

"Pedro de Alvarado and Hernando López de Avila, a very good chestnut mare, for sport and racing, and the half of which Pedro de Alvarado bought or took forcibly upon our arrival in New Spain (Mexico).

"Alonzo Hernández Puertocarrero, a silver gray mare of good racing qualities, that Cortez bought with golden ornaments.

"Juan Velásquez de León, another silver gray mare, very powerful, that we called Short-Tailed, very restless and a good racer.

"Christóbal de Oli, a dark chestnut stallion, very good.

"Francisco de Montejo and Alonso de Avila, a brownish sorrel stallion: unfit for war purposes.

"Francisco de Morla, a dark chestnut stallion, a great racer and restless.

"Juan de Escalante, a light chestnut stallion, with three white feet: was no good.

"Diego de Ordás, a silver-gray mare, barren, fair, but a poor racer.

"Gonzalo Dominguez, an excellent horseman, a dark chestnut stallion, very good and a great racer.

"Pedro González de Trujillo, a good chestnut stallion, a perfect chestnut, that ran very well.

"Moron, a native of Vaimo, a cream-colored stallion, with marked forefeet and very restless.

"Vaeno, a native of Trinidad, a dun stallion with black points: does not go good.

"Lares, a very good horseman, a very good stallion, of a somewhat light chestnut color and a good racer.

"Ortiz the musician and Bartolomé Garcia, who used to have gold mines, a very good dark stallion that they called Muleteer: this was one of the good horses that we carried in the fleet.

"Juan Sedeño, a native of Havana, a chestnut mare, and this mare foaled on the ship. Said Juan Sedeño passed as the richest soldier that there was in all the fleet, since he brought his own vessel, and the mare and a negro, also cassava and bacon: because at that time one could not find horses nor negroes except at their weight in gold, and the reason of not carrying more horses, because there were none."

Of this contingent of sixteen horses, two were killed in the first battle. Alvarado, who joined Cortez at Vera Cruz with 150 men, brought 20 horses. Narvaez followed with 980 horses.

Cortez completed the conquest of Mexico within two years, after which horses continued to arrive with adventurous Spaniards hastening to the land of silver and gold.

The horses taken to Mexico, beginning in 1519, together with those landed in Florida by De Soto, 115 in number, in 1539, and of which a few were later abandoned on the west bank of the Mississippi River, comprise the nucleus from which sprung the wild horse herds of Mexico and Texas, known as Mustangs, which later overran the prairies and furnished the mounts of many Indian tribes.

Of the horses landed by Cortez, two were of the famed Jennet breed of Spain, which may account for the fine type of animals often found in the wild herds of after years.

The Mustangs repeated the bay, gray, dun, and other colors usually found in Spanish horses, and by constant interbreeding developed the piebalds or pintos of white spotted with bay, sorrel, or dun.

As the Spaniards carried no forage, the horses were accustomed to grazing, and, when once they had strayed from the domesticated herds to the prairies, they had only to protect themselves and their colts from the attacks of wild beasts and multiply in numbers.

The offspring of these feral horses were as wild as though their progenitors had never known the halter, and when, with the passing

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Painting from life by Edward Herbert Miner

POLO PONY

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Painting from life by Edward Herbert Miner

MUSTANG

of the years, the American frontier pushed its way westward and they first felt the lasso tightening about their necks, it may be readily understood that they put into their resistance all the tricks learned in the struggle for an unfettered existence.

Most of them succumbed in time and became amenable to the control of the Indian and the white man, but some were of indomitable spirit and became the Broncos of unsavory reputation, whose descendants have made possible the exciting scenes at Wild West Shows, Cowboy Reunions, and Frontier Days.

There is no distinct breed of horses known as Bronco, this term being used to indicate individuals of the bucking, fighting, outlaw type, found among range horses of the Mustang breed. Their methods of resistance are not observed among farm horses and seem to have come from the necessity thrust upon generations of progenitors of defending themselves from wolves, mountain lions, and other wild animals which preyed upon the herds.

When the army led the way to the distant frontiers and remained to protect the thin line of pioneers advancing westward beyond the Missouri River, the Indians were found in possession of vast herds of ponies. Not only on the prairies east of the Rocky Mountains, but along the shores of the Pacific as far north as Oregon and Washington, the Mustang had made his way.

In the vicinity of the old missions of California the Spanish adventurers had established ranches which were veritable principalities, and it was there and along the Mexican border that Americans first acquired familiarity with the Mustang as a cow-pony.

The hardy, sure-footed little horses were bought half a century ago to mount the cavalry in Arizona, California, and Oregon.

With opportunity for selection from the herds of Chico Foster and others, maintained on the ranges of the old Spanish grants of Southern California, there was little difficulty in finding horses that possessed tremendous endurance and that carried with apparent ease a trooper and his equipment, averaging one-fourth the horse's own weight, and without forage other than that obtained by grazing at night in herds.

The writer well remembers one of these horses purchased by him and ridden into Mexico in 1880, when the American and Mexican armies coöperated in destroying Victorio, the greatest of all Apache chiefs, and his band. The horse was well described by an ancient writer, Posidonius, a traveler in Spain in the year 90 B. C., as "starling colored," dark-gray flecked with white. This writer further declared these Spanish horses superior to all other breeds in fleetness and endurance. These latter qualities were not due to color, however, for one of the best horses in the regiment, after many years of hard scouting over desert and mountain, was a small dun-colored animal, with a dorsal or dark stripe along the back from mane to tail.

The ancient and always prevalent idea of cross-breeding to improve has brought about great changes in the Western horse herds, many of which now show the Thoroughbred infusion of blood. They may be improved in size, speed, and perhaps appearance, but no admixture of breeds will ever produce a gamer, hardier, and more enduring animal for use in the desert and mountain regions of the far West than the wide-ranging Mustang, hand for hand of height, and pound for pound of weight.

THE MULE

(*For illustration see Color Plate XXIV*)

The mule is a hybrid animal long known in history, and with a record of usefulness and service in war and peace which makes him quite the peer of the more famous war horses.

Strange to say, the mule cannot reproduce his kind, being derived as the result of mating the jack or male ass with the mare, or female, of the horse species. The jack is the normal product of mating a jack with a jennet. Another hybrid, the hinny, may be obtained by mating the jennet with the stallion of the horse species, but the resulting cross is not an animal of useful type.

The ability of mules to endure hardship and perform satisfactory service under adverse conditions has established them in the esteem of farmers and planters throughout the world. Of course, the mule, like other animals, responds to good feeding and care and renders his best service under favorable conditions.

The popularity of the mule is attested by the steady demand and constantly increasing number of mules bred at home and abroad.

The belief, borne out by experience, tends to show that the mule will do the same work as the horse, in many fields of employment, on less food and with less tendency to lameness and disease. The mule is less nervous, less irritable, and is credited with longer lease of life than the horse.

While mules are not exactly temperamental animals, they undoubtedly render the best service in the hands of men who understand how to handle them.

In general form and appearance the mule closely resembles the horse, and in judging mules the same general points of perfection are looked for. The nearer the mule approaches the ideal desired in a draft horse, the more valuable he is from the commercial point of view.

The mule retains certain characteristics of the jack, such as long ears, the peculiarities of the tail, the shape of the hoof, and the unmistakable bray; otherwise the mule does not differ materially from his dam.

Quality in the mule, as in other animals bred for profit, is what all buyers look for. It was considered years ago that almost any old mare capable of having a colt would do to breed for a mule foal; but that unbusinesslike idea has been discarded, and a mare of good conformation, roomy, and of such size as to indicate she can bring into the world a worth-while foal is the standard now kept in mind by all breeders.

The conformation of the mule should be

compact, with a deep body, broad chest, full flanks, short back, and well-sprung ribs. Quality is indicated by a trim, fine ear, clean-cut head and joints, flinty flat bone, well-defined tendons, and soft, silky hair. An active, energetic animal is the type of mule most desired.

In the Army, mules are classed as wagon, pack, and saddle animals, while in the markets they are classified as draft, weighing from 1,200 to 1,600 pounds and from 16 to 17½ hands in height; sugar mules, weighing from 1,150 to 1,300 pounds, from 16 to 17 hands in height; farm mules, weighing from 900 to 1,250 pounds, from 15½ to 16 hands in height; cotton mules, weighing from 750 to 1,100 pounds, from 13½ to 15½ hands in height; and mining mules, weighing from 600 to 1,350 pounds, from 12 to 16 hands in height.

Exceptional mules of large size are usually sold for use in lumber camps and for heavy team-work in Southern cities. Pack mules for the army and for use on mountain trails, usually in connection with mining, are selected from the compact, short-backed, well-muscled animals, strength being more important than height.

Each class is further graded as to perfection of conformation, quality, condition, action, and, of course, soundness, varying from choice to inferior.

There is no special preference as to sex, since mules do not breed. The best mules are those having weight combined with heavy bone, large, well-shaped feet, strong, short backs, closely coupled, with abundant muscle over the loin and hind quarters.

The American jack is a composite of the blood of the best foreign breeds, and in developing him the breeders have emphasized the points most desired in his progeny—size, weight, bone, style, action, and quality.

The jacks selected as sires of jacks are reserved entirely for mating with jennets. The jacks selected for mating with mares to produce mules are not allowed to run with jennets, but are turned out as colts to run with gentle mares and young fillies. The knowledge that the best results are obtained in this way has come from a century of observation and experience.

As a general rule, the color of mules is black, brown, bay, sorrel, or gray, but there are occasional animals of cream, white, or mouse color. Sometimes a spotted or variegated coloring is found. These are known to the Mexicans as pinto, to the Southern negroes as Chickasaw, and to others as calico or circus mules. The solid colors and dark or iron grays are preferred and are believed to indicate the hardiest animals.

The ability of mules to render good service under very unfavorable conditions has induced the belief that they are not subject to the many ailments of horses, but this is not borne out by experience in stables where records are kept.

The writer was for many years in charge of wagon and pack trains, as quartermaster of a cavalry regiment, and had opportunity to observe both horses and mules, in ordinary service as well as during the prevalence of epidemics. Mules suffer from colds, pneumonia, colic, bowel impactions, and all forms of individual complaints in the same degree as horses.

During the prevalence of contagious diseases, like farcy and glanders, and epidemics from germ infections, as in pink eye and influenza, mules were not found to be any more immune than horses. The peculiar, upstanding, flinty hoof of the mule may afford him some advantage over the horse, but he has his share of troubles.

As a matter of historic interest, General Washington's advertisement of the services of the Spanish jack presented to him by the King of Spain should be preserved. It was printed in a Philadelphia paper:

"*Royal Gift.*—A Jack Ass of the first race in the Kingdom of Spain will cover mares and jennies at Mount Vernon the ensuing spring. The first for ten and the latter for fifteen pounds the season. Royal Gift is four years old, is between 14½ and 15 hands high, and will grow, it is said, till he is 20 or 25 years of age. He is very bony and stout made, of a dark color, with light belly and legs. The advantages, which are many, to be derived from the propagation of asses from this animal (the first of the kind that ever was in North America), and the usefulness of mules bred from a Jack of his size, either for the road or team, are well known to those who are acquainted with this mongrel race. For the information of those who are not, it may be enough to add, that their great strength, longevity, hardiness, and cheap support give them a preference of horses that is scarcely to be imagined. As the Jack is young, and the General has many mares of his own to put to him, a limited number only will be received from others, and these entered in the order they are offered. Letters directed to the subscriber, by Post or otherwise, under cover to the General, will be entered on the day they are received, till the number is completed, of which the writers shall be informed, to prevent trouble or expense to them.

"(Signed) JOHN FAIRFAX,
Overseer.

"February 23, 1786."

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Painting from life by Edward Herbert Miner

MULE

(*Continued from page 477*)

but Flemish and Belgian horses of heavy type were in existence when the Romans invaded western Europe, and it is most probable that they supplied the infusion necessary to increase the size of the island stock.

It was not the practice of ancient warriors to use mares for war purposes, and it may be readily understood how every invasion of a country possessing native stock was followed by admixture of blood, with a tendency generally to improvement.

During the Crusades and for several centuries after, the armor worn by the knights was so heavy as to be quite beyond the power of the ordinary horse to carry. From the time of King John to the reign of Henry VIII much attention was devoted to the development of horses of large size, and statutes were enacted to encourage the breeding of the type later known as Shires.

Warriors of the clad-in-armor type relied upon sheer weight to beat down the enemy, for horses bearing upwards of 400 pounds were mere pack animals.

Fossil remains of the horse, as known to us, have been found in Nebraska, Texas, and at various places on the Pacific coast as far north as Alaska. Of especial importance was the discovery of remains in considerable numbers, representing all ages, in the asphalt beds at Rancho La Brea, in California, for it enabled scientific investigators to make comparisons and to determine that the ancient horses were of approximately the size of those of modern domesticated horses, their skulls ranging upward to even greater size than those of the latter.*

The first modern horses to land on this continent were brought by Cortez, and participated in the conquest of Mexico. Ferdinand de Soto brought horses to Florida and used them on his long march to the Mississippi. After his death and burial in the Father of Waters, as that river was long known, his followers crossed over. The horses then taken to the region now known as Texas and abandoned there, together with those coming in from Mexico, were the progenitors of the bands of wild horses that gradually spread over the prairies and became known as Mustangs (see text, page 521, and Color Plate XXIII).

Had the country over which they roamed remained unoccupied by the American frontiersman and settler, the Mustangs would eventually have vied in numbers with the buffalo, which roamed the prairies from Texas to Canada.

There was much of romance connected with the region ranged over by the Mustangs, and each band of wild horses was credited with leadership by the most wonderful stallion ever beheld by man. Many were captured, but the real leaders were always alleged to have escaped by reason of speed not possessed by any domesticated horse. Probably there was much blood of the Moorish or Barb horses among them in the beginning, and as other importations by the Spaniards in Mexico continued during several centuries, the wild bands were joined by others from the domesticated horse herds.

WASHINGTON IRVING'S ACCOUNT OF A WILD-HORSE HUNT

The presence of these wild horses on the prairies led to the organization of many parties bent on their capture. No less a personage than Washington Irving journeyed to the West and joined one of these parties, whose operations he thus described:

"We left the buffalo camp about eight o'clock, and had a toilsome and harassing march of two hours, over ridges of hills. About ten o'clock in the morning we came to where this line of rugged hills swept down into a valley, through which flowed the north fork of the Red River.

"As we cast our eyes over this fresh and delightful valley, we beheld a troop of wild horses, quietly grazing on a green lawn, about a mile distant to our right, while to our left, at nearly the same distance, were several buffaloes, some feeding, others reposing and ruminating among the high rich herbage, under the shade of a clump of cottonwood trees.

"The whole had the appearance of a broad, beautiful tract of pasture land on the highly ornamented estate of some gentleman farmer, with his cattle grazing about the lawns and meadows.

* See "The Larger North American Mammals," by E. W. Nelson, in the NATIONAL GEOGRAPHIC MAGAZINE for November, 1916.

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HIS ROYAL HIGHNESS, THE PRINCE OF WALES, UP

The heir to the throne of the British Empire is an ardent devotee of horse racing. He is here shown taking the water jump during the Brigade of Guards inter-regimental race at Astwell Mill, on his Pet Dog, with Captain W. G. Shaw-Stewart on Jean III.

"A council of war was now held, and it was determined to profit by the present favorable opportunity and try our hand at the grand hunting maneuver, which is called ringing the wild horse.

"This requires a large party of horsemen, well mounted. They extend themselves in each direction, singly, at certain distances apart, and gradually form a ring of two or three miles in circumference, so as to surround the game. This has to be done with extreme care, for the wild horse is the most readily alarmed inhabitant of the prairie and can scent a hunter at a great distance, if to windward.

"The ring being formed, two or three ride towards the horses, who start off in an opposite direction. Whenever they approach the bounds of the ring, however, a huntsman presents himself and turns them from their course. In this way they are checked and driven back at every point, and kept galloping round and round this magic circle until, being completely tired down, it is easy for the hunters to ride up beside them and throw the lariat over their heads.

"The prime horses of most speed, courage, and bottom, however, are apt to break through and escape; so that, in general, it is the second-rate horses that are taken."

This particular hunt was marred by Antoine, the cook of the party, whom Irving described as a mercurial little Frenchman, and who was more successful than he deserved to be, for he managed to catch a beautiful cream-colored colt, about seven months old, which could not keep up with its companions.

SPANISH HORSES PROGENITORS OF SOUTH AMERICAN HERDS

Similarly, in South America, Spanish horses escaped, or wandered off to the uninhabited pampas, and in the course of time were the bases of innumerable small herds. Had they all remained without interference, their numbers would have been much greater; but they were preyed upon by wild animals, especially large wolves and jaguars, which did not hesitate to attack full-grown animals, but were especially formidable to young colts.

In defense, the wild horse was prone to use his hind feet, but in the battles which raged for the leadership of the herds, the stallions used their teeth and struck with their fore feet to the accompaniment of squeals and snorts which signified that to them death was preferable to defeat.

The old stallions habitually drove out the younger ones, but the latter usually managed to win favor and assemble a band of mares of their own following. When the stallion leaders became enfeebled with age they, in turn, were unceremoniously driven out by the youthful and more lusty rivals, perpetuating the survival of the fittest in never-ending round.

ADVENT OF THE HORSE CHANGED INDIAN TRIBAL LIFE

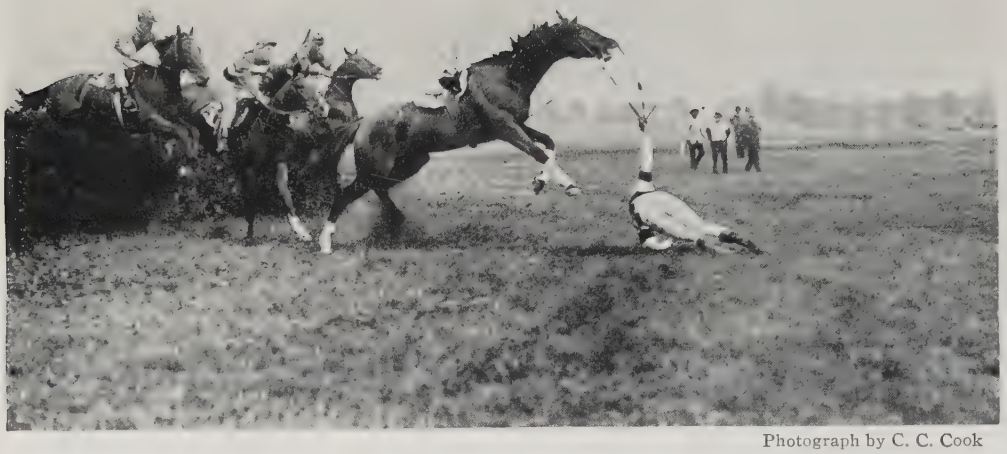
The presence of these wild horses on the prairies was responsible for an entire change in the habits of the American Indians who occupied the plains, as well as of those who were gradually forced back by the ever-advancing frontier of the whites.

Prior to the coming of the Europeans, the Indians traveled on foot and located from time to time their simple villages according to the supply of game, on which they depended mainly for food.

The coming of the horse changed all that, and at an early date the Comanches and other tribes which hunted along the fringes of the buffalo herds began to hunt on horseback and to follow the herds until their supply of skins and jerked or dried meat for the winter season had been secured. This led to infringement upon one another's hunting grounds, which had ever been a cause for war. From that time until the whites had overrun the western country, killed off the game, and fenced in the land, there was no peace among many of the Indian tribes.

Nor were tribal depredations confined to warring upon one another, for the Indians became expert horse thieves and forced upon travelers through the Indian country incessant watchfulness to avoid having their herds run off. The sudden appearance of a band of yelling, painted savages, riding at high speed and waving buffalo robes, would stampede any herd of domesticated animals and render them easy prey to Indian marauders.

The horses introduced along the eastern seaboard by the settlers in Virginia, Penn-



Photograph by C. C. Cook

A STEEPLECHASE TUMBLE AT SHEEPSHEAD BAY, NEW YORK

sylvania, New York, and New England were not all derived from the same source, nor did their breeding proceed along exactly the same lines.

HORSES OF THE COLONIAL PERIOD

The early colonists of Virginia brought over horses, the first of which were eaten during the starving period at Jamestown, but importations continued and it was reported that in 1611, "They have brought to this colony 100 cows, 200 pigs, 100 goats, and 17 horses and mares."

As individual plantations were developed, the need for saddle horses, in a country without roads other than bridle paths through the forests, became great, and it was not long before Virginians were accounted the best horsemen in the colonies.

Washington maintained an extensive breeding establishment to provide horses for his own use and for the improvement of his neighbors' stock. Among the famous stallions of their day at Mount Vernon were Sampson, Magnolia, Leonidas, Traveler, and Gift.

As far back as 1761 George William Fairfax, a near neighbor of Washington, wrote from England expressing a wish that arrangements be made to breed his mare Moggy to Washington's Thoroughbred stallion Gift.

The men of their generation relied upon the horse not only as their sole means of transportation on land, but also for the pleasures of the hunt and the race course.

Washington was not unmindful of the lowly side of agriculture, for his imported jacks from Spain and Malta were at the head of the mule industry of Virginia.

Trials of speed were the occasions of many notable gatherings. Washington was a steward of the Alexandria Jockey Club, and the races in Fairfax and adjoining counties of Virginia always proved strong attractions.

The entire family at Mount Vernon usually attended the races at Annapolis, in the adjacent colony of Maryland. On these occasions the great coach, the coachmen, the footmen, the postilions, and the horses were sent across the Potomac the day before, so as to be in readiness for an early start the next morning.

It does not require much imagination to picture the impression that the arrival of the Mount Vernon cavalcade made on

Photograph by Paul Thompson

THE FRENCH CAVALRYMEN ARE AMONG THE MOST SKILLFUL EQUESTRIANS IN THE WORLD

When Charles Martel defeated the Saracens at Tours and Poitiers in the eighth century, many horses were taken and distributed throughout France. The Crusaders also are credited with bringing home choice animals (see text, page 508).

the ladies and gentlemen of Maryland foregathered for the social gayeties incident to the racing season.

Washington's favorite diversion was fox-hunting. He was always superbly mounted and was reputed a good rider. He habitually dressed for the hunt in blue coat, scarlet waistcoat, buckskin breeches, top boots, and velvet cap, and carried a whip or crop with a long thong in his hand.

His stables and equipages were always in perfect order. It was his custom to rise early and inspect them about sunrise. Except when absent as "general of all the forces of the United Colonies," and later as President of the United States, he continued to give his attention to plantation details to the last day of his life, and rode with the ease and gracefulness of a much younger man.

PRESIDENT WASHINGTON'S HORSES A SOURCE OF ADMIRATION

When Washington was President his horses were a source of surprise and admiration. The coach team of white horses always appeared in spotless condition. The night before they were to be used they were covered with a paste of which whiting was the principal ingredient; then they were swathed in body clothes and bedded in clean straw.

The next morning, when the paste had dried, it was well rubbed and brushed and gave the horses a glossy and satinlike appearance. Their hoofs were blackened and polished and their mouths washed. They were then led forth ready in every respect for the light that has ever beaten upon the equipages of rulers of nations.

Washington and his friends set the pace for tidewater Virginia, and their habits and customs influenced the widely dispersed Virginians as they passed over the mountains to create new commonwealths. Their traditions formed the tapestry of dreams handed down from generation to generation of horsemen, and the spell of the tidewater aristocracy still lingers in the lavender of memory.

Photograph by Henri Besson

FANTASIA (AN EXHIBITION OF EVOLUTIONS ON HORSEBACK) PERFORMED BY ARABS BEFORE A HIGH OFFICIAL OF THE FRENCH REPUBLIC ON A VISIT TO ALGIERS

It was not until about 1750 that the importation of English race horses began. Long prior to that time, however, racing had been a popular sport in Virginia, and the distances were far greater than any run in recent years. Heat races of one, two, and even four miles were common events. The horses were selected by their owners as worthy to carry their colors, as well as their money.

The horses of the early period were small, none being above 15 hands and most of them half a hand less, the measure of a hand being four inches. Just what breeding gave them their speed will never be known. Some had come from Ireland, which had long been noted for its speedy hunters.

Prior to the coming of the Thoroughbred, the winners were mated to perpetuate the speed of both sire and dam.

While the men of fortune were inclined to the long-distance and heat races, another element developed the short-distance horses, which competed over a straight course of one-fourth mile, and from that early period to about the time of the Civil War, quarter racing was a very popular sport, and not confined to regular race tracks. Rarely indeed was there a session of court without its quarter race as a side issue.

GAITED HORSES DEVELOPED IN VIRGINIA

At a very early period the Virginians began the use of pacing and racking horses, and the best animals were bred to perpetuate these gaits as natural gaits of the horse.

In the pace, the horse moves the two feet on each side together; the rack, or single foot, is a movement in which the feet come down singly, in a rapid, shuffling, easy motion, which gets over long distances rapidly and with ease to the rider.

These saddle horses were trained to the single foot, fox trot, and running walk, and in time were found all over the South, being much preferred to the walk, trot, and canter horse usually found in the North.

The pace had been a popular gait in the early history of England, but lost its favor soon after the development of the Thoroughbred.

Photograph by Charles Reid

SHIPPING PONIES FROM THE SHETLAND ISLANDS

Formerly these diminutive horses were used principally in the coal mines and by the fishermen along the coast. When used as a pack or draft animal, the Shetland, weight for weight and inch for inch, can hold his own against the entire horse world (see text, page 489).

Courtesy Metropolitan Museum of Art

"THE HORSE FAIR," BY ROSA BONHEUR

Before this artist's time, women had not attempted the reproduction of animated scenes of this type from animal life. One of Rosa Bonheur's chief claims to fame is the faultless anatomy of her animals. The models for this stirring picture were Percherons, nearly all of them stallions.

It may be remarked that gaited saddle horses have retained their popularity in America wherever riders know how to ride them, for the changes of gaits are all made by the horse upon signal or indication from the rider.

Many fine saddlers have been condemned by purchasers because they had no knowledge of riding a five-gaited horse. It was the Virginia horse that formed the basis of the stock of Kentucky, Tennessee, and other Southern States.

PENNSYLVANIA DEVELOPED THE BIG DRAFT HORSE

The horse industry of Maryland followed closely upon that of Virginia and other Southern colonies, but in Pennsylvania there was a complete change of system upon the coming of William Penn to assume direction of the grant which had been conferred upon him by Charles II.

Beginning in 1676, all horses running at large were required to be branded, and within a few years it was enacted that no stallions under 13 hands should be allowed on the ranges. This law was revised in 1724 and the size increased to 14 hands, all horses found on the public range below that height being altered.

Photograph by Charles Reid

SUCH A SCENE AS LANDSEER LOVED AND PAINTED

The open door of a smithy always has its lure, and every man who owns a horse, sooner or later develops his ideas as to how his favorite should be shod. The one who knows a good blacksmith is fortunate, for there is no truer saying than the old English adage, "No foot, no horse."

Photograph by William Reid

FOUR WILLING WORKERS—CLYDESDALES

America has never developed a heavy horse of its own. The Scottish Clydesdale has been imported, but is not so popular in the States as it is among our northern neighbors, the Canadian farmers. By means of a recently invented horse and mule dynamometer, it has been determined that some horses develop from 8.6 to 21.2 "horse-power," and exert a tractive pull of from 2,000 to 2,300 pounds.

Photograph by Martin Johnson

THE CLYDESDALE AND THE ZEBRA ARE BROTHERS UNDER THE HIDE (SEE TEXT, PAGE 560)

A herd of zebras and gnus photographed in their native haunt in the heart of Africa. The gnu is an animal with the head of an ox, the body and flowing tail of a horse, and the limbs of an antelope.

Photograph by William Reid

THREE FRIENDS

With abundance of nourishing food and protection from inclement weather, the horse of any breed will quickly respond and in a few generations, by careful selection, will bear little resemblance to its early progenitors.

The Pennsylvanians took life more seriously than their Southern neighbors, and at an early date horse racing of all kinds was prohibited under severe penalties.

The whole scheme of the Pennsylvanians, so far as the horse industry was concerned, was to encourage and develop a large type of horse, capable of farm work and of hauling heavy loads to tidewater in the earlier years, and later over the mountains to the head of navigation on the Ohio, whence goods were delivered to the growing settlements as far south as New Orleans by water.

Among the early settlers of Pennsylvania were Swedes, Finns, and Dutch, who brought with them many small riding horses, mainly pacers. During the pioneer period they, like all the first immigrants, relied upon saddle horses to get about the new country, long devoid of roads.

When they had once obtained a foothold, they became the recognized sturdy, plodding, small farmers of the colonies, and it was not long before their horses began to improve, as the appearance and fertility of their farms had done.

In the course of time, when the settlements west of Fort Pitt had created a trade with Philadelphia, the results of the encouragement long given to horse-breeding became evident.

Pack trains can go almost anywhere, but they have always been an expensive form of transportation and one limited in the character of goods which can be carried. The large horses of Pennsylvania were now harnessed to enormous wagons and laid the foundation of the over-mountain traffic which connected with flatboats and barges for delivery of freight along the Ohio, Cumberland, Tennessee, and Mississippi Rivers.

While not creating a new species, they at least gave a name—Conestoga—to both horses and wagons, which made known the wagoners of the Alleghenies in song and story, until the railroads came to displace them and send them to that oblivion which seems to be the fate of all things which run counter to mechanical inventions in an age of industrialism (see illustration, page 475).

In New York and New England there were English horses, used mainly for saddle purposes, but the early Dutch settlers along the Hudson obtained their work horses from the Netherlands. One of the first things done by the British governor of New York, following the surrender of New Amsterdam, was to establish a race track on Long Island, and there has never been a time since when one or more tracks were not in existence there.

Facilities for water-borne communication and commerce have always had a tendency to retard the development of the horse. However, as settlers filled up the interior of New York and overflowed into the Western Reserve, the character of the horses began to change.

FAMOUS FAMILIES OF HORSES FROM NEW YORK AND NEW ENGLAND

While New York and New England have never been regarded as horse-raising districts, some wonderful families, notably the Morgans, the American Trotter, and the Narragansett pacers, had their origin and main development there.

Certain small districts are the homes of some very important breeding ventures, but references here concern the more general phases of the horse of America.

With the exception of the horses introduced by the Spaniards, mainly in the far West, it is fair to assume that nearly all the horses brought into the colonies prior to the Revolution came from the British Isles. As a class, they were small horses, very few of the earlier importations exceeding 13½ hands.

It does not require much research to find the reason for the prevalence of so many pacers in the colonies. The British Isles were invaded by the Romans half a century before the Christian Era.

During the first century the islands were permanently occupied and continued as a Roman province until the middle of the fifth century, when the garrisons were withdrawn to the Continent to resist the invasion of the Huns.

During this long occupancy many roads were constructed and there was an abundance of horses. The saddle gait most prized at that period, and for more than a thousand years afterwards, was the pace, or the amble.

Photograph from Edwin Levick

WHEN THE FOX HORN SOUNDS, YOUNG AND OLD ASSEMBLE

This young man of Sussex, England, mounted on his shaggy steed, has attended fox meets strapped in his hunting saddle-chair since he was a year old. The white horse has apparently turned away in disgust at the novel arrangement.

Soon after the American colonies were established along the Atlantic seaboard the pace was decreed unfashionable in England, but that fact did not immediately eliminate or stop the importation of pacers, nor prevent the transmission by imitation of that gait to descendants even to the present time.

The distinct breed of Saddle Horse, the many-gaited animal, resulted from crosses on pacing stock, and before the advent of cheap automobiles they were found on nearly all Southern farms.

THE TRAIL OF THE HORSE THIEF

The American pioneers and their descendants have always loved horses. In fact, many of them, in early days when settlements were few and far between, exhibited such admiration for other people's horses that stringent laws were enacted in the older States to prevent unauthorized change of ownership, and anti-horse thief associations and vigilance committees existed in all parts of the country to relieve the courts of trouble.

Many years later organized bands of horse thieves maintained a flourishing business along the Mexican border in Arizona by stealing alternately from each side. They did not limit their selections to private animals, but ran off stock from government herds.

On one occasion angry cattlemen trailed them and captured one near the post at which the writer was serving, in New Mexico. The thief was brought to the trader's store in the fort to wait for absent members of the posse to come in. After some delay the cattlemen assembled and then decided that it was useless to ride ten miles to the nearest jail, and got ready to hang the culprit to a government telegraph pole. It required a show of military force to persuade them to move with their prisoner off the military reservation.

It took four years to raise a horse,

Photograph by P. O. Bugge

AMERICAN TOURISTS IN SCANDINAVIA EMPLOY THE STURDY NORWEGIAN DUN IN SIGHT-SEEING

AN ICELAND PEASANT ON HIS FAVORITE HORSE

In an island where there are practically no railroads, no canals or navigable rivers, and no motor highways, horses constitute a large part of the wealth of the farmers.

Photograph by Charles Reid

DOCILITY: FULLBACK ON A SCOTCH FARM

Photograph by C. R. Miller

DYNAMICS: A "BRONCO-BUSTER" IN ACTION

Photograph by Charles Martin

THE ARTILLERY GROUP OF THE MONUMENT TO GENERAL ULYSSES S. GRANT AT THE HEAD OF THE MALL IN WASHINGTON, D. C.

On the north and south pedestals of the great marble superstructure are two spirited groups in bronze representing the Cavalry and the Artillery, as if in a mad rush toward the center. The horses in the groups are wonderfully modeled. Henry Merwin Shrady, the sculptor, himself a horseman of skill, spent 15 years upon the work and died just two weeks before the great monument was dedicated. On the lofty central pedestal Grant, in his familiar slouch hat and Army cloak of the Civil War campaign, sits upon a horse modeled after one the General actually rode.

HORSE MILLINERY

Both manicure and millinery are modern requirements of the workaday horse.

Photographs by Brown Brothers

A MIDDAY MEAL FOR WORKING HORSES

Societies for the prevention of cruelty to animals have long objected to these feeding bags. The dust and spelts are inhaled into the horse's lungs. In European cities one will see the cab drivers leave them about the horses' necks for hours.

Photograph from The Pendleton Round-Up

RIDING A BRONCO

Breeders of good horses have, as a general rule, given up the rough methods of breaking animals practiced during early days in the West, and are exercising more kindliness and intelligence in their training.

while four days were usually sufficient to take one across the border line beyond recovery.

Some day automobile thieves may be given equally short shrift, when that form of stealing will become as rare as horse stealing became in the days of the Vigilantes.

BREEDING STANDARDS

Utility is the test ordinarily applied in life, and when the old has ceased to measure up to the modern demand, it has always had to give way to improved methods. This principle has been applied unrelentingly to farm animals, including horses of all classes.

Having discovered, for instance, the combination in mating which produced speed for racing, the breed was confirmed in name and place, as the Thoroughbred, by persistent rejection of the unsuccessful and breeding only those that had consistently shown the speed and staying qualities to win.

Similarly, when breeding for size and strength, it was essential to select with care the big horses that were reliable in transmitting the qualities sought, which included equable temperament, nervousness always counting against the acquisition and retention of flesh, so essential in the draft horse.

At the opposite extreme is found the

Photograph from The Pendleton Round-Up

A DARING BIT OF HORSEMANSHIP

Plunging from a galloping mount to the neck of a madly fleeing steer, the cattleman throws his animal and ties it. The feat is known in frontier parlance as "bulldogging." Buffalo Bill astonished England when he took his bucking broncos to that country, and it was only the utter failure of experienced horsemen to stay in the saddle that convinced the Britishers that the animals were not merely trick horses spoiled in the training.

pony, suitable for children, where diminutive size is the main consideration—a condition often defeated by the persistent inclination of all types of horses to increase in size in an environment characterized by abundance of rich food.

The immensity of our country and the diversity of its climate and agricultural resources have made possible the introduction of many breeds of horses to replace those discarded or to meet new and hitherto unfilled demands.

The utilization of farm machinery has given a very general impression that the horse is no longer necessary, and that the breeding industry has gone into a permanent decline.

When there were unlimited range and cheap forage, large numbers of inferior horses were kept. With increasing land values and curtailment of open ranges, the scrub is making way for something more profitable. There are altogether too many inferior horses still occupying stalls on American farms, but the increase in numbers of improved breeds constantly serves as a lesson to those who still waste feed on animals not up to the most profitable standard.

Farming has not been as profitable since the World War as it should have been. The cost of farm labor has been extraordinarily high, and whenever a farmer feels the need of cutting down labor and expense, almost the first idea which suggests itself is to sell surplus stock. This has been done, and there are indications now that the low-water mark has been reached, and that breeding of horses will increase again in the near future.

THE PERCHERON IS THE MOST POPULAR DRAFT HORSE IN AMERICA

For many years American breeders have ventured into the field of heavy draft horses, and experience obtained seems to have led to a general trend toward the Percheron as the best suited of the heavy horses for America. The numbers of the several breeds of imported

Photograph from The Pendleton Round-Up

"PRAIRIE ROSE" HENDERSON RIDING "BRANDY"

It is remarkable that while most of the horses of the North and South American continents in modern times are descendants of the animals introduced by the Spaniards, the development of the prehistoric horse has been traced almost wholly from fossil remains found in this hemisphere (see illustration, page 458).

draft horses reported in the United States on January 1, 1920, were 70,613 Percherons, 10,838 Belgians, 5,617 Shires, 4,248 Clydesdales, and 2,964 French drafts.

Preference in such a matter is not a mere whim of fashion. There must be practical advantages in the form, action, and general qualities of the Percherons, or they would not exceed all other breeds by more than two to one. Possibly climate has something to do with it, for the extreme variations of temperature in winter, causing alternate freezing and thawing, with attending slush, are decidedly unfavorable to animals with heavy growths of hair about the lower legs, as is the case with the Shires.

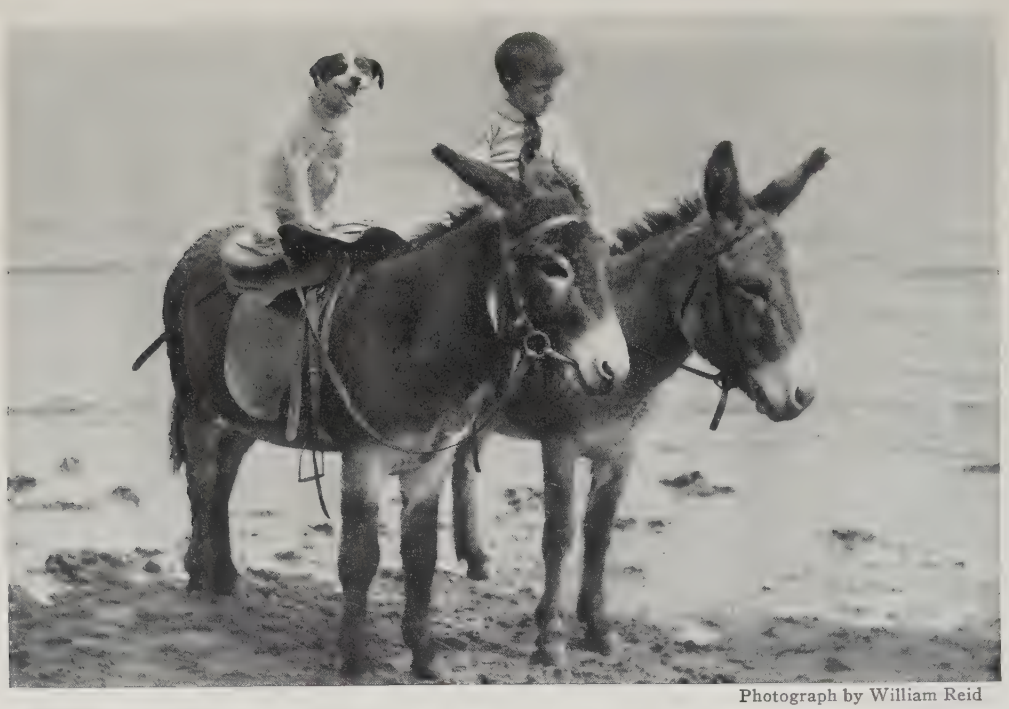
It is not uncommon to see American-bred Percherons weighing upward of a ton each at two and three years of age. Their carriage is attractive, and their legs are clean, with generally fine feet. Altogether, they make a most satisfactory, handsome, and useful draft animal.

Like most fat animals, they are not consistent breeders, but their number is steadily increasing, and their crosses on native mares, of good frame and suitable conformation, supply a middle-weight draft horse for which there is always a steady demand. To date, the truck and the automobile have not been able to supplant this type in his chosen field.

The small automobile has lessened the demand for light horses, formerly used on farms for saddle and light buggy combination horses, but the rising cost of gasoline and repairs, together with the comparatively short life of the car, may eventually restore the combination saddle and driving horse for local use, reserving the car for urgent or distant travel.

REMOUNT BREEDING

The preservation and increase of this type of horse play prominent parts in all plans for national defense, but unhappily, after every war, those who proclaim the millennium and fly in the face of current events and of our own history are



Photograph by William Reid

DONALD, DOG, AND DONKEYS AT THE SEASHORE IN SCOTLAND

To children the donkeys are one of the chief attractions at Portobello, near Edinburgh.

welcomed, while those who urge, as of old, that we keep our powder dry are denounced as militarists.

In the face of many obstacles and discouragements, the military authorities have gone steadily forward during the past 20 years in standardized and continuous efforts to keep alive and expand the breeding industry, in so far as it relates to horses suitable for military service and for which there has been a diminished commercial demand.

The road of progress has been long and rough, and without the voluntary assistance of men of vision in civil life success might have been turned into failure many times. Through contributions and by purchase from very limited appropriations, the Army Remount Bureau has been enabled to distribute throughout the country stallions of suitable type to breed remounts for the Army.

The very small price allowed for the purchase of horses has caused an abandonment of the usual preferred option on colts. Breeders who develop occasional high-grade animals are thereby enabled to sell them at such profit as to help out in the case of misfits.

While at peace, the Army does not have to purchase heavily, but the system has to be maintained for the day of need. The training and experience obtained by officers and their assistants in carrying on the remount administration are worth to the Government each year more than the entire cost of the system from the beginning.

The types of horses bred under the encouragement of the Remount Bureau are not restricted to any particular breed, but preference is shown for the Thoroughbred cross on selected mares.

More Thoroughbred stallions are distributed to breeding areas than all other types combined, but this is in accordance with the expressed wishes of agents. Arabian, Saddle Bred, Morgan, and Standard Bred stallions are made available for those who desire those crosses.

In order to make public the relative merits of the different breeds, endurance rides have been established, where the choicest horses of each type may meet and establish their claims to superiority.

Photograph from U. S. Signal Corps

GASSED AND SHELL-SHOCKED

A Missouri mule of the American Expeditionary Forces in France being led to a dressing station behind the lines near Vaux.

Horses of unknown breeding are not eligible for entry.

Such tests cannot be applied with all the elements necessary to a positive determination as to which breed is best for a particular purpose, but they do show that all the horses entered are superior to ordinary animals devoid of good blood.

To establish relative values, it would be necessary to enter the same number of animals of each type in the race. So far as public interests are concerned, this would settle nothing beyond the relative merits of individual horses.

To establish an order of merit as a basis for army purchases, there should be foundation stock of each type in equal numbers in the country. That condition can never be made possible. The tests to date have established the Arabian horse, both the pure and part bloods, in high esteem; yet the total number of Arabians in America is insignificant as compared with the needs of an army in war times.

Similarly the Morgan (see page 516), a real American horse, has reëstablished his old reputation for gameness and stamina; yet the total number in America is too small to rely upon even for a serious impress as sires.

© Herbert G. Ponting

A MULE MARKET

According to the U. S. Department of Agriculture, "the ability of the mule to endure hardship and perform sterling service under adverse conditions has established him as a real asset in American agriculture. In 1910 the number of mules on farms and ranches was 4,209,769. The number on January 1, 1920, was 5,432,391—an increase during the decade of nearly 30 per cent. Nearly three-fifths of all the mules in the United States are found in the nine cotton-belt States of the South."

© Asahel Curtis

CROSSING THE SNOW FIELDS TO PANHANDLE GAP, MOUNT RAINIER NATIONAL PARK

It would be almost impossible to make the trip through the snow fields and glaciers of majestic Mount Rainier, whose summit is a glistening beacon to many a mariner far out at sea, without the patient horse, which carries food and other provisions to camp sites on the heights.

Photograph by Charles Martin

THE MUCH-MALIGNED STATUE OF GENERAL ANDREW JACKSON IN LAFAYETTE SQUARE, FACING THE WHITE HOUSE, WASHINGTON

The sculptor has depicted the spirited mount of the Hero of the Battle of New Orleans at the moment when the guns are first heard (see text, page 566).

The Thoroughbred is the only one of the breeds having representatives in the tests that exists in numbers sufficient to make a creditable showing within a reasonable number of years. The same conditions exist with the Saddle Bred and American trotting horses as in the case of the Arabian and Morgan, though not quite to the same extent.

NOT NECESSARY FOR THE GOVERNMENT TO BREED CAVALRY HORSES

More than a quarter of a century ago the author was called upon to prepare a textbook on the horse for the use of the Army, and after maturely considering the question of breeding remounts, wrote:

"It is safe to conclude that the horses required for public service will continue to be purchased from private breeding farms. With so unlimited an agricultural country, there should never be any lack of suitable horses of any class for which there is an active demand at fair prices.

"It is not necessary for the Government to breed horses for cavalry purposes. Equally as good, if not better, results may be obtained by training a large number of officers to the duty of inspecting and

selecting the best animals produced on American farms and buying them from breeders whenever possible."

The horse, if selected with care and properly used, is capable of rendering long and valuable service. The merest lout who can ride fairly light may take a horse over an immense distance in a single ride; but he will in all probability expend the entire vital force of the animal and leave him a broken-down, spiritless wreck at the end of his journey.

HORSE CASUALTIES IN WAR

There is an infinite amount of hardship and drudgery connected with the mounted services, and the loss of animals in all wars is very great. During the Civil War, in 1864, the Federal Army required more than 500 horses each day to replace losses. During the first eight months of 1864 the cavalry of the Army of the Potomac used up 40,000 horses—an average of two remounts to each man.

Similar conditions have prevailed in other armies. During the Russian campaign, 1812, Napoleon crossed the Niemen with 187,121 horses, of which 60,000 belonged to the cavalry. Ten thousand died between the Niemen and Vilna because of bad roads and lack of food, and 92,000 had succumbed before the first fall of snow, mainly from starvation. Six months of such campaigning had practically destroyed the cavalry, which recrossed the Niemen with 1,600 horses.

During the retreat of the British to the seacoast at Coruña, in the Peninsular War, carried out in rain, sleet, and snow, the loss of horses was nearly complete, and the few that survived were shot on the beach to keep them from falling into the hands of the French.

When the French general Masséna marched out of Portugal during the same war, he started with 8,000 horses and lost 195 of them each day during the continuance of his retreat. Similarly, the losses in the Crimea in 1855, when the British and French operated together against the Russians, were very large, mainly due to starvation. Within a few months the number of British cavalry and artillery horses was reduced from 5,048 to 2,258.

As the history of nations goes, it is probable that the glory accruing from the "Charge of the Six Hundred" compensated the British for all their losses. The experience in the Crimea was a mere bagatelle to that in the Boer War, 1899-1902.

Photograph by Brown Brothers

BOOTED, SOCKED, AND KNICKERED

The elbow and ankle boots are worn to prevent abrasion from the metal shoes; the quarter boots around the hoofs prevent concussion when the feet come in contact with the pavement, and the toe-clips, screwed into the hoofs, make the animal extend itself when trotting or pacing.

The probability of a horse's reaching an advanced age does not depend as much upon race and breeding as upon his environment and care. Neglect, food insufficient in quantity and poor in quality, alike tend to shorten the duration of the horse's life. In this way one horse may be old and worn out at 12 or 14, while another may continue to render good service until 20 to 25 years of age. There are numerous instances to justify the statement that horses have lived to reach the age of 35 or 40 years.

It is very generally accepted as a fact that horses which mature slowly live longer than those which mature rapidly, provided, of course, they receive like

Photograph by Haas, New York

A PROUD PRODUCT FROM THE KENTUCKY BLUE-GRASS COUNTRY

treatment and are not put to hard service until fully grown.

It is usually claimed that mares live longer than horses, and small horses longer than large ones, but it is difficult to prove such statements, because all animals are not subjected to the same treatment.

HOW TEETH SHOW A HORSE'S AGE

The difference in general appearance between young and old horses is very marked. It requires but little familiarity with horses to detect the extremes of age and the contrary condition.

After maturity, more reliance is placed upon the indications afforded by the teeth than upon outward signs. Structural alterations take place in the teeth every year up to the sixth; hence there can rarely be any question as to the age of a horse, as indicated by the teeth, up to that time.

After the horse has obtained his full set of teeth, the age can be determined approximately by the effect of wear in altering their shape, by the receding gums, and by other signs. The teeth of a young horse come together in front at a very obtuse angle and appear to be almost perpendicular to the jaw in which set; those of an old horse, on the contrary, appear to be almost in the prolongation of the jaw.

The front teeth of a young horse are broad in the direction of the jaw, but as the teeth are worn off they gradually assume a circular shape on the top surface. Horses have tusks between the front and jaw teeth, but the mares seldom develop them.

The mule has long been appreciated in America and several other countries, but it has remained for recent years to expand its reputation to practically all parts of the world.

Mules have been bred and used in Europe from ancient times, especially in the mountain districts of southern France, Spain, and Italy and numerous islands belonging to those countries. They were not relegated entirely to mountain trails and farm drudgery, for they were favorite animals for use in royal carriages and as relays on the post roads before steam and motor transportation had become generally available.

Of course, the modern mania for speed sounded the passing of the slower mail coach, but there was a distinct loss to the

Photograph by Haas, New York

"TEMPTATION," A BLUE-RIBBON HACKNEY, IN ACTION

traveler, who sacrificed the intimate view of life obtained under the more sedate method of traveling, especially in a foreign land.

Very early in the history of New England a considerable trade was built up in the sale of horses in the West Indies. There followed a demand for mules, and many small animals of that breed were shipped from New England. It was not, however, until after the Revolution that the breeding of mules assumed large proportions.

In 1786 the King of Spain presented to General Washington a jack and jennet of the Andalusian breed, and later he received a Maltese jack from the Marquis de Lafayette. The jack, known as Royal Gift, presented by the King of Spain was unusually large (see text, page 525), but by crossing the Maltese jack on the Andalusian jennet, Washington became the possessor of a famous sire, which he named Compound.

COTTON GIN CAUSED INCREASE IN COTTON ACREAGE AND MULES

With the invention of the cotton gin, the planting of cotton increased by leaps and bounds, and similarly the development of sugar plantations reached proportions demanding large numbers of mules.

The land of cotton and sugar was not as well adapted to stock-raising as the blue-grass country to the north. In preparing to supply the demand for mules, it was necessary first to secure jacks.

The Spaniards had been raising small donkeys, or burros, in Mexico and the southwestern part of the country for many years, and had crossed the jacks on the Mustang mares; but the mule resulting from that breeding, while a useful little animal, was not of sufficient strength to do heavy agricultural work.

During the period when the States bordering the western flank of the Alleghenies and beyond, which turned out to be the best possible land for stock-raising, were being opened up and prepared for agricultural use, Europe was in the midst of wars and the sources of supply of jacks were not accessible.

Toward the end of Napoleon's career, America became involved in the War of 1812-15, so that for a long period Virginia remained in undisputed control of the mule market.

Photograph by Brown Brothers

CLEARING THE BARS AT SIX FEET FOUR INCHES

Before the introduction of steamships, the transportation of horses and other animals across the Atlantic was attended with many losses. Once the business became reasonably safe, men of vision were willing to invest in the highest grades of stock in Europe, and soon Americans were literally combing Italy, Spain, Malta, and France for the choicest of their jacks and jennets.

It was not long before the buyers discovered in La Vendée the famous jacks of Poitou, which have left such a deep impression upon American stock. The prices paid for many of these animals, including the pro rata distribution of losses in transit, were extremely high, but the salability of their progeny assured a safe and satisfactory return on the investment.

The development of the mule industry in Kentucky, Tennessee, Missouri, and other States, without flourish of trumpets, has been one of the outstanding successful ventures of the past century.

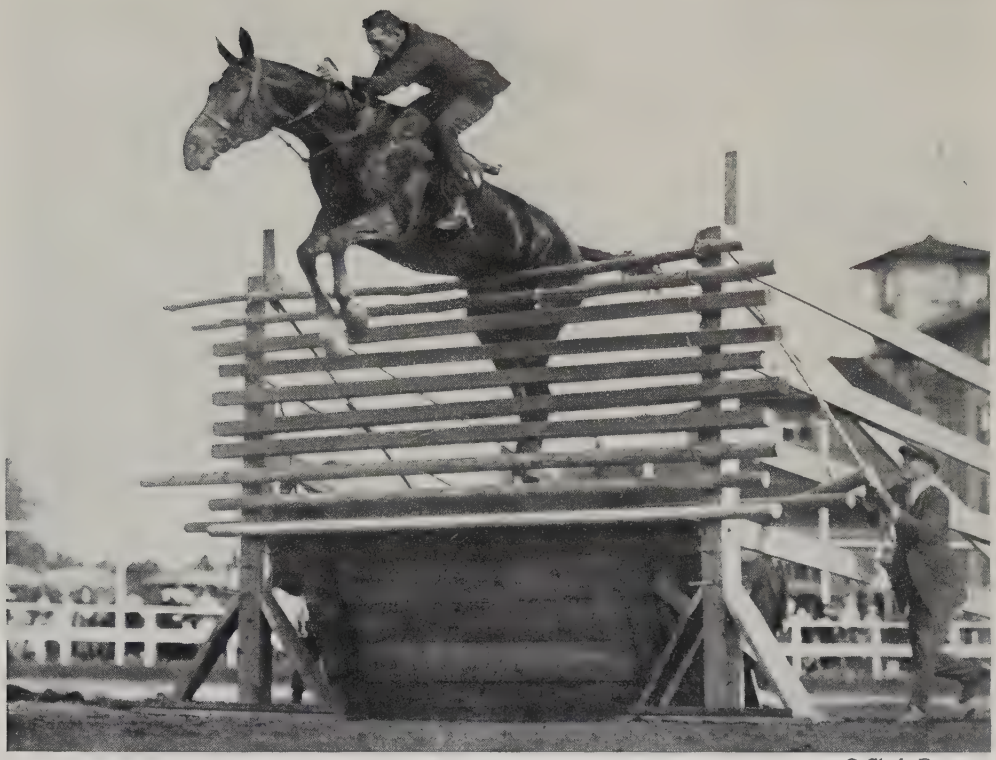
The number of mules in the country has steadily increased, and the last census showed a total of 5,810,641—a gain of considerably more than 2,000,000 in 20 years. These were bred almost wholly from native jacks, the importation of those animals having practically ceased. Nearly three-fifths of the mules in the country are in the nine so-called cotton-belt States.

The Civil War taught Americans the great value of the mule. There are no greater hardships than those incident to making war. The animals employed by the armies of the Union numbered one for every two men, and they hauled the heavy wagons over well-nigh bottomless roads during the whole four years' struggle. In fact, the war could not have been carried to a conclusion without the faithful army mule.

In the Boer War in South Africa the British turned to America for both horses and mules, but it was the latter that surprised the transport department by their ability to render good service under peculiarly trying conditions which killed off the horses like flies.

THE MULE A DEPENDABLE ALLY ON THE INDIAN TRAIL

The American Army has long recognized the ability of the mule to do hard work on less forage than the horse, and



© Clyde Brown

"GREAT HEART," EIGHT-YEAR-OLD THOROUGHBRED, BREAKING A WORLD'S HIGH JUMP RECORD

This wonder of the horse world, on June 9, 1923, cleared the hurdles at 8 feet 13/16 inches at the South Shore Country Club Horse Show, Chicago. The old record of 8 feet ½ inch was set at Ottawa, Canada, by Confidence, which is said to have made an unofficial record of 8 feet 2 inches.

the official ration of grain has always been one-fourth less for mules than for horses. Perhaps the writer may be permitted some reference to personal experiences during many years of military service.

The army mule has often been credited with stubbornness, ill temper, a tendency to kick, and to give up more quickly than a horse when discouragement strikes him.

The first unfamiliar trait in the mule which attracted my attention was while scouting after Apaches in the mountains of Arizona, where there were no roads and few good trails.

The trail of Indian marauders was certain to lead into rough country, and to approach them at all, night marches were necessary. Frequently a trail would fork and it would require careful examination to determine which one the advance party had followed.

The pack mules never seemed to have any difficulty. As long as they could hear the tinkling bell of the leader, usually a white mare ridden by the cook, they moved along unconcernedly.

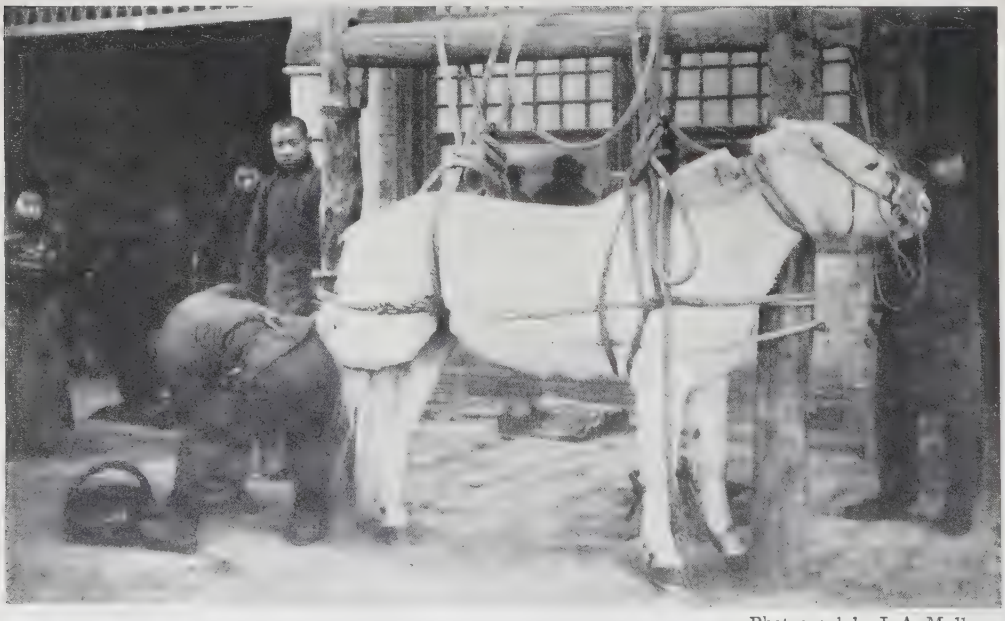
In the night or during mist and rain, the mules which had fallen behind would put their noses to the ground and without any hesitation follow the fresh tracks. They would come into the camp on the darkest night without hesitation, when cavalrymen, leading their horses, would sometimes lie out until morning after having become confused as to the trail.

It was undoubtedly the sense of smell, which is highly developed in the mule, that enabled him to discern where the

Photograph by Knud Sorensen

MONGOLIAN WOMEN ON THEIR WAY TO A FESTIVAL

The four horsewomen with elaborate headdresses are the married members of the group. Men and women use the same types of saddle. The Mongols practically live on horseback, and when forced afoot develop an unsteady, rolling gait (see "The People of the Wilderness," in THE GEOGRAPHIC for May, 1921.)



Photograph by J. A. Muller

CHINESE METHODS OF "SAFETY FIRST"

This strait-jacket would be worthy of a surgical operation, but the mild-mannered horse is only being shod.

Photograph by U. S. Department of Agriculture

THE ZEBRASS, A HYBRID ANIMAL, AND ITS MOTHER

The offspring of horse and ass—our common mule—has so many of the excellent qualities of both animals that repeated efforts have been made to mate the zebra with the horse. The result has been only a qualified success. The colt shown here was sired by a zebra and its dam is a mare. Note the stripes around the front and hind legs and the zebraic ears.

turf had been bruised or fresh earth turned up.

PACK MULE GIVES WARNING THAT SHE MIGHT DESERT

While in charge of the regimental pack trains in Mexico, when the American and Mexican troops coöperated in destroying Victorio's Apaches, I was ordered to leave the command on the return march to the American side and assemble supplies at Apache Pass, in the Chiricahui Mountains of Arizona.

I selected a very small pack mule, often used by parties on hunting trips and accustomed to leaving the bell mare, although all pack mules do that regretfully. I was accompanied by the regimental quartermaster sergeant and one private, who was killed in that vicinity by Apaches on a subsequent raid.

We crossed the San Simon Valley from the Stein's Peak range to the Chiricahui Mountains and traveled on an old Indian trail until darkness set in.

When it had become dark enough so that no Indians could see when we left the trail, we turned up a ravine and, after going into the mountains some distance, climbed to the top of the bare divide separating two ravines and unsaddled to rest until daylight.

The horses and the mule were secured with lariats and we lay down without starting any cook fire to attract attention. The moon was shining with the brightness peculiar to the Arizona region, and I covered my face with my campaign hat and went to sleep.

The horses were tired with their long journey and after grazing awhile had lain down. The little mule, accustomed to night herding with the pack train, continued to move about, and finally managed to loosen the lariat from the bush to which she was tied. The average mule would have smelled out the back trail and returned to the bell mare, but the little animal with us seemed to understand our plight, so she came and put her muzzle

Photograph by Mark W. Stevens

THE LAST RUN OF THE FIRE HORSES OF DETROIT

The city of automobiles converted its last remaining horse-drawn fire-fighting machinery into motor-driven apparatus in 1922.

against my hat and awakened me. She seemed to know that if she was not tied up again she might abandon us, so I got up and secured her once more.

MULES GIVE UP WHEN WATER GETS IN THEIR EARS

Mules give up easily in water, if it gets in their ears, but I have seen teams drag heavily loaded wagons through the vilest quicksands, urged only by the voice of a humane driver. Much depends upon the handling of any stock, and mules respond to gentle treatment as readily as does a Thoroughbred.

I was nearly ruined for life by a vicious mule, a notorious kicker; but mules are no more given to kicking than horses, except that they are more often fed under sheds in common troughs and acquire habits of crowding and kicking for choice places.

The good and not the occasional vicious characteristics of the mule should be expatiated upon, for with our growing population and the foreign markets open to America, the annual production of mules should reach the half million mark in a few years.

When the breeding of horses on any blue-grass farm is discontinued, the breeding of mules is the proper and natural substitute.

There are some congeners of the jack and the mule which may be properly mentioned here, although they have never played any useful part in the service of mankind.

Ordinarily wild animals which prey upon each other, and especially those which attack domestic stock, are made away with unceremoniously whenever opportunity offers, but those which merely eke out a precarious living by grazing in desert or unoccupied country are allowed to survive. Among these may be mentioned the wild asses of Asia and Africa, the zebras, and the quaggas. All these species are included by zoölogists as one genus in the horse family (see pages 480, 481, 485, and Color Plates II, III, IV, and VI).

The horse has some very distinctive characteristics, however, in the long

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CAPTAIN L. E. G. OATES AND SOME OF THE SIBERIAN PONIES THAT HELPED CAPTAIN SCOTT TO REACH THE SOUTH POLE

Nineteen of these hardy animals were carried on the *Terra Nova*. They were the especial charge of Captain Oates, of the Inniskilling Dragoons, who, with frozen feet, sacrificed himself on the return march from the Pole in an effort to relieve his comrades of his impediment.

mane, the tail covered with hair, short ears, and a forelock of hair between them, while in proportion to its size its legs are longer, its hoofs broader, and its head smaller than in the species known as asses and zebras.

Between the last two named there is a general distinction easily recognizable, in that the asses are usually of plain color, while the zebras are distinctively striped.

THE ZEBRA REFUSES TO AID IN BEARING MAN'S BURDENS

Leg stripes, and especially line stripes along the spine, are common in certain breeds of horses and have given opportunity for much scientific discussion as to their origin. The asses are not all marked alike, those of Asia being quite distinct from those of Africa, just as the stripes of the Mountain zebra differ from those of Grévy's and Chapman's zebras (see text, page 480, and Plates II and III).

While there are known instances of zebras having been trained to harness, they have successfully resisted all efforts to induce them to participate in modern civilization by bearing a part of man's burden. Of course, that failure would have caused their annihilation had they been so situated as to be in the way of or had persisted in grazing lands desired by man.

Experimentation in crossing the male zebra on the mare of the horse species or burro or donkey mares has resulted in animals of no practical value (see illustration, page 559).

THE HORSE IN MOTION

From the earliest period when artists and sculptors began to depict horses, the

Photograph by A. W. Cutler

THE "NOTION AND NOVELTY" MERCHANT OF PALERMO: SICILY

Many of the small "shops" of southern Italy and Sicily are perambulating, the physical "push" of the keeper or the "pull" of the faithful little donkeys, the chief beasts of burden in those countries, being the main motive forces for their circulation through the villages and towns.

Photograph by J. T. McGarvey

THE HOBNAILED WHEELS OF THE CHINESE CARTS LEND PICTURESQUENESS TO PEKING STREETS

From the great Mongolian plains to the north of the Celestial Republic come the wild ponies which were domesticated before the Aryans migrated to Europe (see page 558).

Photograph by W. F. Robertson

A SACRED HORSE OF JAPAN IN ITS TEMPLE STALL

Before the arrival of Americans, the Japanese horse was never used as a draft animal (see "The Empire of the Risen Sun," in THE GEOGRAPHIC for October, 1923).

idea of motion, especially of the gallop, was represented by an extension forward of both fore legs, and similarly to the rear of both hind legs (see pages 460 and 461).

When, through the instrumentality of instantaneous photography, it was learned that the feet of the galloping horse never occupied the positions indicated by the artists, there was a sense of confusion and perhaps of humiliation that for so many centuries we had been sufficiently guileless as to accept the artist's version of the horse in motion.

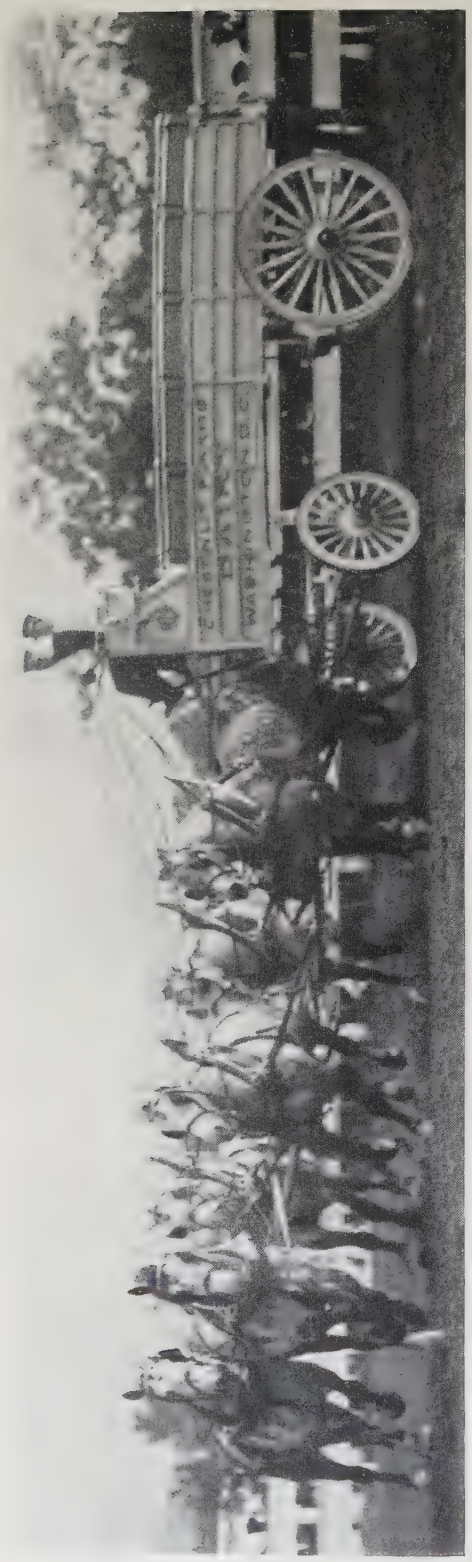
We now know that at the moment of the stride, when all the feet of the horse are off the ground, the soles of the front feet are turned up and not down, as in the old pictures. It should be remembered, however, that when the camera catches the horse with his legs folded up under him in the air, it is not motion, but one arrested instant or position of movement—a complete stop, in other words.

To the untrained eye a single view of the horse in such a position does not indicate the gallop any more than it does a "buck" jump in the air. In the other periods of the stride, when the horse is on one foot, as shown by the instantaneous photograph, there is no suggestion whatever to the ordinary mind that the horse is running or galloping (see pages 473 and 475).

ARTISTS ATTEMPTED TO REPRESENT CONTINUOUS ACTION

It is only by remembering the positions of the horse's feet at the walk and trot that the trained eye comprehends the fact that the horse shown on one hind or fore foot is running.

The artists undertook to represent motion as a continuous action, and no one ever misunderstood what was represented. When an artist paints a snow scene, the shadows are generally indicated as blue; but we know that a handful of snow is



A BLUE-RIBBON SEXTET OF HEAVY DRAFT HORSES

These grade Percherons (three-fourths to seven-eighths pure bred) have taken prizes at many horse shows. They are from seven to nine years of age and under normal conditions will be in service until they are 17 or 18. They weigh from 1,900 to 2,250 pounds each and their market value is from $1,000 to $1,250 each. They have been exhibited at Fort Myer, Va., as true type of heavy artillery horse.

white. We now know the relative positions of the horse's feet at each instant of motion, through scientific analysis of instantaneous pictures, but none of the latter truly represents anything but a moment of arrested movement.

The artists may never come into their own again, because modern education demands specialization and acceptance of scientific proof of the error of common belief. No one, however, has yet pictured the horse, either in painting or by photography, in such manner as to convey the sense of exhilarating motion at the gallop, with the feet and legs shown as science has now established them at each instant of that gait.

While the artist's method of painting the horse at a gallop probably originated in Egypt (see page 461), it found its way to the Orient and was unhesitatingly accepted by all the then known world as an easily understood representation of continuous motion at speed.

PICTURES OF RUNNING HORSE RESEMBLE SPEEDING DOG

As a matter of fact, the old illustrations of the running horse more nearly picture the movements of the dog at speed than anything else. If the actual trail or footprints of the running horse be examined, it will be found that the feet do not operate in pairs, but that each comes to the ground in turn, making imprints akin to those made by the spokes of a rolling wheel with the tires and felloes removed.

In jumping an obstacle at speed, the instantaneous photographs usually show the front feet extended as if the horse would land on both of them at once, but he never does; for, the instant he approaches the ground, he prepares to land on

A PORTRAIT PAINTER OF HORSES AND ONE OF HIS MODELS

Mr. Edward Herbert Miner, the artist who painted the 24 canvases from which the illustrations in color appearing in this number of THE GEOGRAPHIC were reproduced, in his studio at Westbury, Long Island. Most of Mr. Miner's paintings were made from life.

one foot and places the other forward for the next step in his stride (see illustrations, pages 474, 528, 556, and 557).

The public is becoming quite familiar with the appearance of race horses at speed by reason of the publication of many photographic illustrations. These modern pictures show the present jockey seat, which was adopted under the belief that it materially increases the speed of the horse by putting the weight of the rider over the shoulders instead of on the back.

It is quite impossible to tell just what improvement in speed has come from the new seat, because both horses and tracks have been undergoing constant improvement. The jockey seat is unsightly and insecure and would not be retained a moment if it was not believed that it enables a particular horse to make faster time on any track than he could make over the same track with the rider sitting down on his back, as in the old seat.

Ever since the construction of the famous wooden horse at the siege of Troy, in which more attention was paid to the accommodations for a detachment of soldiers in its interior than to its appearance as a work of art, it has been the custom to criticize horse statuary. This tendency to criticize is seldom applied in judging statues of other animals, such as cats and dogs, and yet there are hundreds of people who possess those household pets to one who owns a horse.

Of course, one does not have to be a horse-owner to be a distinguished critic of horse statuary, for sculptors have learned that on that subject the man in the street ranks high.

WASHINGTON'S EQUESTRIAN STATUES MUCH MALIGNED

Washington probably contains more equestrian bronzes than any other city in America, and not one of them is safe from the jibes of the public, because it has become the fashion to criticize them. Each new generation of sculptors seems to add fuel to the flame by pointing out the weird defects and shortcomings of this or that statue; and yet there is much to be proud of in the bronze horses of the Capital, besides the fact that they perpetuate the memory of men who have rendered the state some service.

Probably the most criticized of the many statues is that of Andrew Jackson, which was cast from cannon captured at the battle of New Orleans, specially to commemorate the defeat of an army of Wellington's Peninsular War veterans, commanded by his brother-in-law, at the hands of American forces comprised mainly of militia.

No other sculptor has followed Mills' example in reproducing a general's charger in the act of rearing, yet that attitude is taken intuitively by many spirited horses at the sound of the guns, or even at the first notes of a military band where drums are much in evidence. Mills has caught the horse in one of these familiar positions and has shown General Jackson retaining his seat in perfect balance (see illustration, page 552).

Andrew Jackson was not only a lover of horses, but a rider of rare ability, and the rearing of a nervous or excitable horse was not apt to disturb him in the saddle.

Presuming that Mills designed the pedestals of the Washington and Jackson statues, some modern sculptors might take a leaf from his book of experience, for the later custom of placing statues on high pedestals, as are those of General Sherman and General McClellan, restricts close observers to a view of the horse's belly. In all exhibitions of pictures, some are doomed to occupy the sky-line, but there is no necessity for this in the placing of statues in public parks.

Taken as a whole, the equestrian statues of deceased generals in the public parks of Washington are truer to life, and as works of art are superior in quality to the incongruous group in Statuary Hall, under the dome of the Capitol, contributed by the States.

The people of America have many reasons for pride in the Capital of the Nation, not the least being the beautiful avenues, broken at intervals by circles containing equestrian statues of distinguished generals who have received generous recognition for services in past wars.

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FISHES AND FISHERIES OF OUR NORTH ATLANTIC SEABOARD

By John Oliver La Gorce

Author of "A Battle-Ground of Nature," "Pennsylvania, the Industrial Titan of America," "Devil-Fishing in the Gulf Stream," "Treasure-House of the Gulf Stream," "The Fight at the Timber-Line," etc., in the National Geographic Magazine

THE story of the fishes and fisheries of the North Atlantic seaboard of the United States is one that has the fascination of a romance.

Whether we consider the biology of the species which are the prizes of the fishing fleets, the methods of reaping this harvest of the seas, or the stern battle against the depletion of the supply, there are stirring chapters at every turn.

The world annually levies a tribute upon the seven seas of half a billion dollars' worth of fish, of which Europe collects approximately half, the United States nearly a third, and the remainder of mankind the other sixth.

In terms of weight, the portion collected by the United States amounts to 2,600,000,000 pounds, including shellfish. Three-fourths of this annual harvest reaches the markets in fresh condition; the remainder goes to the consumer as canned, salted, and smoked fish.

The North Atlantic fisheries of the American seaboard reach from the Newfoundland Banks to the Delaware River, and represent the major sea fisheries of the Atlantic coast, producing some seven hundred million pounds of sea food annually.

Considering the fisheries of the United States in these waters, one finds upward of fifty different kinds of fish and shellfish called for by fish-eating citizens, helping to swell the total annual catch. Eighteen kinds have more than two million pounds each to their credit in the national larder.

MIGRATING EYES

Biologically, perhaps the most interesting of all the species that figure in the returns are the Flatfish—Flounders and Halibuts—with their changing forms and migrating eyes. By what strange quirk of Nature the left eyes of species inhabiting cold water usually migrate to the right side of their heads, while the right eyes of most species inhabiting warm water journey over to the left, no scientist will venture a guess (see Color Plate II).

When they are hatched, all Flatfish are of orthodox symmetrical shape, with conventionally placed mouths and eyes.

After they swim around in ordinary fashion for a little while, the members of the Flatfish family exhibit a tendency to turn to the one side or the other. Immediately after this peculiar desire begins to develop, the eye on the lower side seems to acquire a wanderlust. Stephen R. Williams, who studied this change, says that the optic nerves are placed in the youngling to provide for the migration.

The first sign of the transformation is a rapid change in the cartilage bar lying in the path of the eye that is to migrate. Then comes an increase of the distance between the eye and the brain, caused by the growth of facial cartilages. In the

A NOVA SCOTIA FISHERMAN HAULING IN HIS NET

As pressure on the world's food supply of every kind increases, knowledge of the migration, feeding, and breeding habits of fish is essential to the formulation of intelligent fisheries legislation in order to conserve the abundance of the ocean's supply of this palatable and nourishing food.

Photograph by International Newsreel

THE "SACRED CODFISH" IN THE BOSTON STATE HOUSE

In the new Hall of Representatives, in Boston, hangs a wooden Codfish "as a memorial of the importance of the Cod Fishery to the welfare of this Commonwealth," in accordance with a resolution passed in 1784. It may be seen above the transom of the door. Next to the Herring, the Cod is the world's most important economic fish, and the Cod fisheries of the Newfoundland Banks are the oldest in North America. Georges Bank, southeast of Gloucester, also is a favorite fishing ground.

Winter Flounder, three-fourths of the 120-degree migration takes place in three days. What if that should become a human habit!

THE ORIGIN OF FLATFISH

The extent of the eye migration and of the flatness of the species is closely related to its habits. The Sole and the shore Flounder, which keep close to the bottom, are more twisted than the Halibut, the Sand Dab, and the Summer Flounder, which are more given to free swimming.

How this deviation from the conventional bilateral shape arose is a mystery. Whether there came a "sport" in the family tree at some stage of its history, or whether the deviation grew from a gradual modification of the adults under

Photograph by H. Armstrong Roberts

HAULING NETS DOWN TO THE SEA

Though America's total fish crop, according to recent figures, amounts to 2,600,000,000 pounds, we probably eat less fish than any other country of the world—only 24 pounds a year per capita as against 60 to 70 pounds in Europe. The United States Bureau of Fisheries has performed valuable service not only in inducing the public to eat more fish, but also in popularizing new varieties.

the influence of their environment, cannot be said. If it came from the latter, selection naturally favored its appearance earlier and earlier in the development of the fish, until it reached the larval stage. Earlier transformation would be disadvantageous, since there is a lack of plankton — that imperative, if almost microscopic, food supply of the newly hatched— at the sea bottom, and the transformed fishlings would find a scarcity of provender at a critical period in their lives.

It has been noted that many transformations do occur even in the egg; but the precocious youngsters thus hatched have less chance to survive, and hence are less able to transmit to the future the tendency to earlier change.

THE ANADROMOUS FISHES

Some species that help constitute the fisheries of the North Atlantic are anadromous—that is, they spend most of their lives in the sea, but come into fresh water to spawn. Among these are the Salmon, the Shad, the Alewife, the Sturgeon, and the Striped Bass. On the Pacific coast the most striking instance of this is the Chinook Salmon, which ascends the Columbia River for a thousand miles, and the Yukon for two thousand, to find its spawning ground.

How acute this instinct has become is shown by a Canadian experiment. Salmon were accustomed to run up the Nicola River to spawn, and at one place they passed an island in midstream. It was noted that they always took one channel around this island and neglected the other. So a dam was built across the channel they were accustomed to use and the other was left open.

At the next run, when the fish approached the barrier across the channel their ancestors had used in passing the island, not a single one of them would take the other channel. They all turned back instead.

Sometimes anadromous fishes, wandering up rivers, get into landlocked lakes. Usually they do not prosper, but die out in their new environment. It often happens, however, that such anadromous fishes as the Branch Herring and the Salmon, getting into waters out of which they are unable to find their way, so change their habits in the course of time that variations from their ancestors set in, which mark the beginnings of the formation of new species.

THE EELS' SPAWNING HABITS

Other fishes of commercial importance in North Atlantic waters have habits of spawning directly opposite to the anadromous species, and they are called catadromous fishes. The true Eel is the most striking example of this class of fish.

Until recently, the location of its spawning ground was an unsolved mystery of the sea. Finally a Danish expedition succeeded in locating it in the region between Bermuda and the Leeward Islands, where the water reaches the depth of a mile.

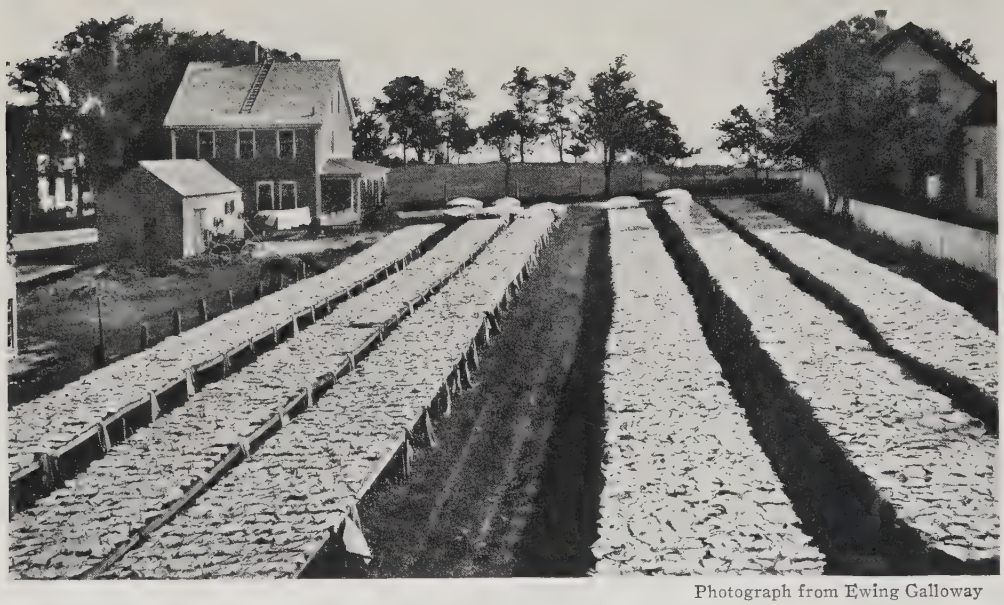
Although they are so nearly alike that the layman cannot recognize the difference between them, and although their breeding grounds partially overlap, the European and American species neither cross nor visit one another's shores.

The eggs are laid at depths of about 650 feet and the larvæ continue to rise toward the surface as they grow. At this stage, and until they reach their respective shores, they are mere bits of ribbon, so transparent that the vertebræ of their backbones may be counted without difficulty. The only difference yet found between the European and American species is that the European has a few more vertebræ.

EELS AT THE PARTING OF THE WAYS

Both species start out, mayhap together, over a route neither has traveled before. But when they come to the parting of the ways the European Elver, with a three years' journey ahead of it, says good-by to its American cousin, which has only a year's swim to get to its future home. By what means this unerring homing instinct is transferred from the parents, which never return, to the offsprings, that must travel a road they have never been over, is a mystery that will probably long await a solution.

The spawning habits of fishes differ as greatly in other respects as in those just mentioned. Some eggs are laid at the surface and left to their fate, with no responsibilities of any kind for the parents; others are heavy enough to sink to the bottom. Some fishes, like the King



Photograph from Ewing Galloway

DRYING FISH AT DIGBY, NOVA SCOTIA

When fish is dried in the open air, it sometimes must be protected from sunburn by canvas awnings, and from rain at night by coops. Although fish is also dried in some factories in large steam-heated shelf driers, this method tends to be too rapid, so that the fish is dried only on the surface, instead of uniformly throughout.

Salmon, lay their eggs on the stream bed, and the male covers them with gravel, after which male and female drift helplessly down the stream, tail first, and die.

THE LUMPFISH A DEVOTED GUARDIAN

Some species, like the Sticklebacks and the Lumpfish, guard their eggs until they are hatched. The courage and devotion of the male Lumpfish to his task has often been noted. He eats nothing while guarding the eggs, but constantly fans the egg mass to keep it free from silt and bathed in flowing water. He never deserts his post save to drive away some intruder, and finally, when the eggs are hatched, he is a picture of exhaustion and hunger.

The males of other species, including some of the common Catfishes, carry the eggs in their mouths until they hatch. The females of still other species, following the example of the Lobster, glue their eggs to the undersurface of their bodies (see text, page 583). The male Sea Horse opens up a little pocket beneath its body, takes in the eggs from its mate, and carries them in the tiny pouch Nature provided until they hatch. Hundreds of perfectly formed Sea Horses are thus liberated at a hatching, so tiny in size the human eye can hardly distinguish them, yet perfectly formed.

Not all fishes are oviparous. Some are viviparous, such as most Sharks, the Sawfishes, the Rosefishes, the Rockfishes, and the Surf Fishes.

The number of eggs laid varies widely in different species. Scientific census-takers of Uncle Sam report that the Herring lays about 25,000, the Sturgeon about 635,000, the Halibut as many as 3,500,000, while the Cod has been known to lay more than 9,000,000.

SLIM CHANCES OF SURVIVAL

One can gauge the perils through which the various species of fish pass from the egg state to maturity by the number of eggs they spawn. It is demonstrable mathematically that if all the eggs of a single female Herring were to produce similarly productive generations, in ten

CANNING LOBSTER MEAT

The Lobster forms the principal means of livelihood in many New England communities and supports a fishery from Labrador to Delaware. The toothsomeness of the American variety was early recognized, and a regular fishery has existed on the Massachusetts coast for nearly a century. The fishing grounds are being depleted rapidly, the size and number of Lobsters caught are diminishing; hence the center of the fishery has shifted northward, first to Maine and then to the Canadian provinces.

years the oceans would be overflowing with Herring, and all the other creatures of the sea literally would be crowded out of existence.

Indeed, it has been proved that, if only three eggs from each female of each species should develop into adult fish similarly productive, fish life would multiply so rapidly that the seas would soon become vastly overcrowded. What does happen is that less than one egg in two million in the Cod produces a reproducing Cod, and even in the Herring less than one in ten thousand successfully runs the gamut of existence. Hard, indeed, would be the road of life insurance companies of the fish world!

ENEMIES OF FISHES

In this connection it is interesting to note that Nature's need for females in many species exceeds the requirement for males. In the case of the Conger Eel, the ratio is nineteen females to every male, and in that of the Herring, three females to every male.

The perils fish have to face are innumerable. Huxley estimates that only 5 per cent of the Herring destroyed annually by all Herring enemies in the world find their fate at the hands of man.

The other 95 per cent are the victims of whales, the porpoise family, seals, and other mammals; Cod, Haddock, Mackerel, Sharks, and other fishes; gulls, gannets, and other birds; and the thousand and one other enemies that lurk in their wake at every stage, from the newly spawned egg to the adult fish.

How tremendous this toll of the other-than-man enemies of the Herring actually is may be gathered from the statement that man himself is credited with an annual catch of nearly eleven billion Herring. On that basis we must conclude that over two hundred billion Herring annually fall victims to their enemies in the sea—enough to load a solid fish train reaching around the earth at the Equator.

Huxley has called mankind an association of Herring catchers, and if those

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A TRIO OF STURGEONS TAKEN AT CAVIAR, ON THE DELAWARE RIVER, IN NEW JERSEY

The Sturgeon fishery has been so intense as to make the taking of these fine fish to-day a comparatively rare occurrence. The largest one taken this year measured 10 feet 3 inches long, weighed 450 pounds before being dressed, and yielded 103 pounds of roe. With the meat selling for 50 cents a pound and the roe for $2.75, the fish brought $350.

fish be counted that are caught by fish which feed on them and in turn feed us, he probably has not missed the mark much.

He also reminds us that single schools covering half a dozen square miles may contain more than three billion Herring; yet many schools have been recorded that covered an area of 20 square miles (see text, page 629).

THE MIGRATIONS OF FISHES

The migration of fishes forms one of the most fascinating romances of the sea. We have seen how the Shad, the Salmon, and other species spend their adult lives in the sea and seek fresh water in which to spawn; how others, such as the Eels, spend their lives in rivers and lakes and seek salt water at spawning time.

The Mackerel and the Flying Fish families wander wide from their usual haunts at spawning time. Other species follow the great schools of Menhaden about the seas, "a full dinner pail" being their first consideration in their life as in ours.

However, for the most part, keeping a complete check on the movement of the fishes of the seas is a problem still awaiting solution. The exact winter home of the common Mackerel is unknown, though a few have been caught with Cod lines in deep water off Grand Manan, and others have been taken from the stomachs of Cod on Georges and La Have Banks, as well as off the coast of New Jersey.

Photograph from Bureau of Fisheries

A FEMALE LOBSTER "IN BERRY"

The number of eggs produced by a female Lobster varies from 3,000 to 75,000, according to its size and age. They are glued to the under-surface of her body, and carried around for about ten months before hatching (see text, page 583).

For a long time it was supposed that the Hickory Shad spawned in Chesapeake Bay, but investigations in that region from 1912 to 1922 failed to reveal a single member of the species under six inches long present in those waters. Its spawning grounds have not been located.

Likewise, the spawning grounds of the Red Tunny have never been discovered. This fish has successfully eluded every effort to trace its tracks through the deep seas.

So, also, is it with the Squeteague, or Weakfish. Appearing in Chesapeake and Delaware Bay waters in April, and in

LOADING SARDINES FROM A WEIR TRAP INTO BOATS: NEW BRUNSWICK

Though fish are not commonly regarded as meat, there is no characteristic difference between fish flesh and that of animals. Protein and water form the bulk of fish flesh, and, pound for pound, there is almost as much protein in fish meat as in beefsteak. Oily fish, such as Shad, Herring, and Eel, are especially nutritious. Fish roe usually contains more protein than beef and some fat in addition.

Buzzards Bay in May, they stay until October, but where they go then is still a secret of their own.

The migratory movements of Herring are so complex that, although ichthyologists have been trying to fathom the mystery for many years, a complete solution has not yet been found.

TAGS TO TELL THEIR STORIES

During the past summer the United States Bureau of Fisheries decided to make a careful study of the migrations of the Cod, the Pollock, and the Haddock.

It has been tagging 10,000 of these fish—about 80 per cent Cod, 15 per cent Pollock, and 5 per cent Haddock—and turning them loose, in the hope that the fishermen of the waters they inhabit will return the tags of those caught, with information about the locality in which they were taken, a record of the date, and of their size (see page 578).

For each tag returned, the fisherman receives 25 cents and the thanks of the Bureau of Fisheries.

In the tagging operations the fish are caught with hook and line at a depth of not more than 20 fathoms. The uninjured fish is laid on a wet board, measured, and its exact length recorded. A metal tag stamped U. S. B. F. is then securely attached to the upper part of the tail, near the base, and the fish is released after a record is made of its number, its size, where released, etc. It is confidently expected that many fishermen will go to the trouble of assisting the Government by reporting to Washington when such fish are taken.

SIDE LIGHTS ON THE EVOLUTION OF FISHES

A study of the anatomy of fishes and the evolution of some of their organs throws an interesting light on life in the ocean.

In order to see under the water, the eyes of the fish had to be constructed on lines differing somewhat from those of man and land animals. Cutting open a fish's eye, one discovers that the crystalline lens is almost a perfect sphere instead of the somewhat flattened lens of land animals. This arrangement is necessary to sight in the water, since the difference in density between the lens and the water is so slight. The result is that fish are extremely nearsighted.

The fish's power of hearing is decidedly muffled, and it is believed that what we know as the ears are solely organs of equilibration, as they partially are in man.

The sense of taste appears to be largely wanting in fish. Their tongues are without power of motion and lack delicate membranes. They swallow their food very rapidly and usually without mastication, further than getting it small enough to gulp it down.

Air dissolved in water offers fish what little oxygen they need, and the oversupply they get when out of water is fatal to most species, though some, like the Catfishes, can live for a considerable time out of their native element. A man uses thousands of times as much oxygen as a fish.

THE EVOLUTION OF THE AIR BLADDER

The air bladders or swim bladders of fishes help them to solve their respective problems of hydrostatics admirably. Bottom fishes have small ones and species that range between the surface and the bottom have relatively large ones. The gas with which air bladders are filled is secreted from the blood in most species.

The evolution of the air bladder from a lung and the perfection of the gills to a point where they furnish oxygen enough, and therefore render lungs useless, may be traced in species still existing. In more primitive fishes the air bladder has a tube connecting it with the throat, and instead of being an empty, gas-filled, sealed sac, it is a true lung, made up of many lobes and parts and lined with a network of small blood vessels. The Gar Pike has a lunglike air bladder, and gulps air from the surface of the water. As the oxygen-assimilating gills develop in going up the scale of fish evolution, the air bladder becomes more a float and less a lung, until the latter use entirely disappears.

THE FUNCTION OF FINS

The major fins of fishes correspond strikingly to the limbs of land mammals. Those back of the gills are known as the pectoral fins and correspond to the arms

Photograph from Bureau of Fisheries

THE GENTLE ART OF TAGGING FISH

Government scientists have been doing noteworthy work in investigating the life habits of migratory food fishes by taking thousands of them, placing identification tags on their tails, and then liberating them. Wet gloves are worn by the experts during the operations because dry hands remove the glutinous veil from the scales of the fishes and expose them to the attacks of many forms of parasites.

of humans. If the bones to which they are attached are examined critically, they will be found somewhat similar to the shoulder girdle of land mammals.

Below the pectoral fins are the ventral fins, which correspond to the hind legs of quadrupeds. The dorsal fin on the back, the caudal fin at the root of the tail, and the anal fin beneath the body are used to maintain equilibrium or direction.

NATURE'S BREEDING METHODS

Nowhere is the art of camouflage more strikingly employed than in marine life. The master breeder of the ages, Nature, has provided highly certain, if very slow, methods of eliminating the unfit from reproduction.

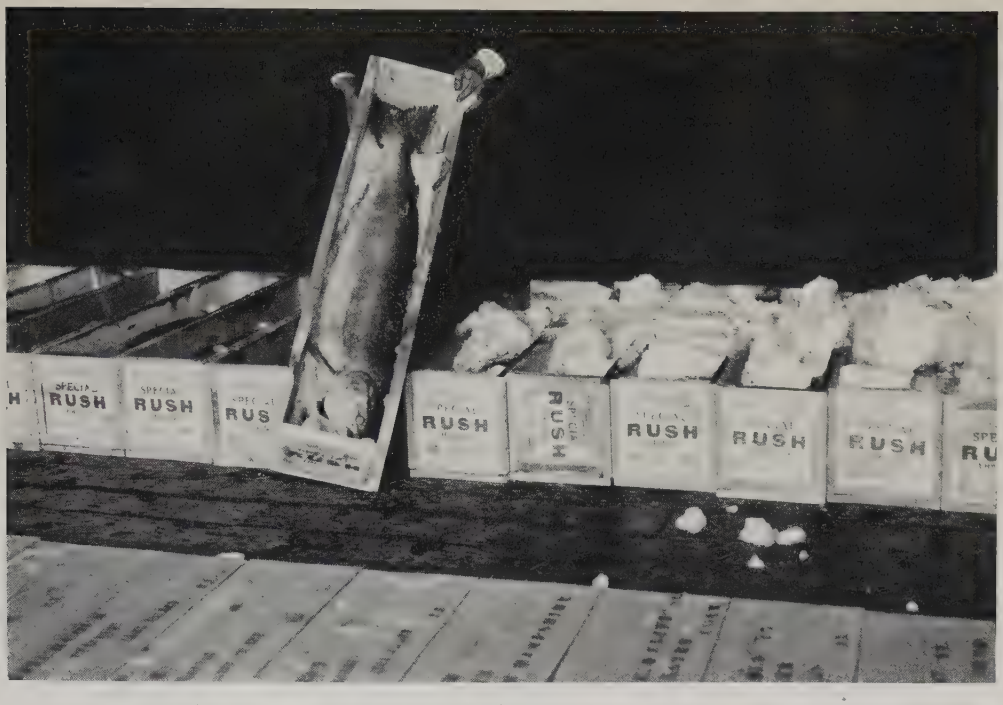
One method is by tests of brute strength, as in the battles of bull seals; another is by the elimination of the sluggards, as in the pursuit of the Herring by the Mackerel. A thousand and one methods are available.

None is more nearly certain among fishes than that which removes those failing to make proper use of the art of camouflage. Note the hues of a Herring in the color section (see Color Plate IX). Its back corresponds to the shades of the water in which it thrives; viewed from the air, it has low visibility. Its belly corresponds to the appearance of water when viewed from beneath the surface. The fishes best protected by their camouflage escape their enemies most frequently, and therefore have a better chance to reproduce. The ones that are least protected fall victims more easily, and therefore are less likely to reproduce.

So, even if ever so little in each generation, the process goes on—ever the better fitting each and every thing that reproduces life to the environment in which its fortunes are cast.

USING THE ART OF CAMOUFLAGE

The Flounder, the Halibut, or the Sand Dab, lying on the sand, has harmonizing blotches imprinted all over the upper part



HOW THE SPORTY SALMON COMES FRESH TO AMERICAN DINNER TABLES

Each of the beautiful specimens from the fishing communities of our northern coasts and Canada rides into American markets in a special berth padded in frazil ice and snow, and thereby is unharmed and delicious when it arrives. Fish packed by this method have been shipped 800 miles inland without showing signs of deterioration.

of its body, imitating the various kinds of sand on which it lies, whether that be common brown sand, crushed coral, or rotting lava. The least successfully camouflaged individuals face the greatest peril and the most successfully concealed ones enjoy the greatest safety.

Man's success in breeding horns off the ox, the long nose off the wild boar, and great size into draft horses, are but a few passing examples of throwing Nature's processes into high gear and hastening the transformation. He has done less in this respect with the fishes than with almost any other form of life, for the reason that he has had less control over them.

But, even at that, he has been able to breed pugnacity into fishes, as witness the fighting fish of Siam, where the natives have fish fights as exciting to them as are cockfights to the masses in Spanish America.

While not a fish, the Lobster, belonging to the crustacean group of animals, supports one of the most interesting and important fisheries of the American shores of the North Atlantic.

The Lobster, biologically, is a closer relative of the spider than of the fish, and the problem of saving the Lobster fisheries from utter depletion is one of the most difficult with which the fish culturists have to deal.

THE LOBSTER'S HABITS

The American Lobster (see Color Plate XVI) is found only on the eastern coast of the United States. Its known range covers a strip of the North Atlantic ocean reaching from Labrador to North Carolina, with the Maine and lower Canadian shores as the region of its greatest commercial abundance. This strip of water is from 30 to 50 miles wide and from 6 to 600 feet deep.

From the close of its early free pelagic life to its old age, which often stretches into decades, the Lobster never leaves the sea bottom of its own accord. Its external world is the ocean floor, and it is content to stay there.

Photograph by H. Armstrong Roberts

DRYING NETS NEAR THE VIRGINIA CAPES

Important industries have arisen from the by-products of American fisheries. One of the oldest is the fish-scrap industry, utilizing the offal for fertilizer and for chicken and cattle food. Fish oils, used in the manufacture of cheap soaps, lubricants, and paints; Cod-liver oil, valuable medicinally; North American isinglass, used in clarifying certain beverages, in making adhesives, India ink, and a sizing for textile goods; glues and cements, are other by-products. Last year workers in Toronto University discovered that "insulin," prepared from the pancreas of the Shark, was useful as a palliative for diabetes.

Having considerable power of locomotion, it wanders around as winter approaches, from the shallow inshore waters to the deeper ones of the 100-fathom line, searching for water of comfortable temperature and for suitable food, and attending to the duties of reproduction.

Its instincts constantly lead it to conceal itself, sometimes to take its prey unawares, and at others to hide from its natural enemies.

THE FOOD OF THE LOBSTER

It walks over the sea floor on its slender legs, which are provided with brushes of sensitive hairs. With its large claws put forward to offer little resistance to the water, it keeps its "feelers" waving back and forth continually to detect danger as well as to discover game its eyes may have overlooked.

The buoyancy of the water makes the Lobster light on its feet in its native environment, but its body weight is too great for its legs when out of water.

Though a great scavenger and tending to be nocturnal in its search for food, it is believed that the Lobster prefers fresh food whenever that is available. Fresh Codfish heads, Flatfish, Sculpins, Sea Robins, Menhadens, and Haddocks make excellent bait, but balls of putrid, slack-salted Herring seem just as attractive.

When hungry, the big crustacean will burrow in the sand like a ravenous pig rooting for grubs, and it has been known to attack even a full-sized Conch, breaking its shell away, piece by piece, and gluttonously devouring the soft parts.

The Lobster is a cannibal by nature, preying on its weaker brethren, and did not the conditions under which it is hatched favor its immediate and wide dispersion, it would largely exterminate itself.

BATTLES WITHOUT QUARTER

Like dogs, Lobsters have frequently been observed to drag dead prey to some secret spot, bury it, and then mount guard over the cache, ready to defend it against all comers. And often many grim battles are fought over such caches. Indeed, few of the giant Lobsters that have been taken are without numerous scars that tell in no uncertain language of pitiless struggles to which they have been party, where quarter was neither asked nor given.

In the American Museum of Natural History in New York a giant Lobster is preserved whose living weight was 34 pounds. It was captured at Atlantic Highlands in 1897. The Smithsonian Institution has one whose living weight is estimated at 25 pounds.

Dr. F. H. Herrick, the author of the United States Bureau of Fisheries' striking study of the American Lobster, thinks that all of the thirteen titans he lists as weighing more than 20 pounds were not giants by nature, but rather simple favorites of fate, which allowed them to live to a riper age than their smaller fellow-creatures. Good luck never deserted them until they became stranded on some inhospitable beach or entangled in some fisherman's gear. Such Lobsters as these, he believes, have weathered the perils of at least half a century.

THE MOLTS OF THE LOBSTER

Few living creatures have such striking habits of changing their clothes as the Lobster. It begins to molt or discard its outgrown clothes the second day after hatching, and continues to do so with decreasing frequency until it has ceased to grow at all.

Nowhere else in Nature is the molting process so striking, so critical, or so abrupt.

When the old shell becomes too small a new skin begins to grow underneath it. When this growth nears completion the Lobster becomes a "shedder," ready to cast off not only its old shell, but even the lining of its esophagus, stomach, and intestine.

Restless and uneasy as the molt approaches, there comes a break where the tail joins the shell. The Lobster then turns over on its side, bends itself in the shape of a "V," with the break at the apex. Pressure is applied, and gradually the rear end of the old shell breaks loose from the new one beneath.

Step by step the process of liberating the imprisoned body from its outgrown armor sweeps forward, until finally the claws are withdrawn through the narrow openings. Presently, with a mighty effort, the Lobster emerges from its old coat of mail, casts off the linings of its digestive tract, and steps out, full-panoplied in a soft new shell.

© Ewing Galloway

UNLOADING HALIBUT: BOSTON, MASSACHUSETTS

In the Gulf of Maine the Halibut has been seriously depleted by overfishing, but fortunately it has been discovered in such abundance along the deeper slopes of the Banks that at first it appeared inexhaustible. New England Halibut fishermen have operated for years in the neighborhood of Sable Island.

The area of a cross section of the flesh in the largest part of one of its big claws is four times greater than that of a cross section of the second joint, through which it must be drawn. The process, therefore, reminds one of pulling wire through the holes of a drawplate.

From six weeks to three months are required for the soft-shelled Lobster to become a hard-shelled one again.

ENEMIES OF THE LOBSTER

The Lobster has many enemies, but, next to man and his alluring traps, the Codfish ranks as its worst foe. With an appetite that doesn't stop at a hard shell up to eight inches, and with a particular taste for young Lobsters from two to four inches in size, the Codfish is a tremendous competitor of the Lobster palace.

During their younger lives, Lobsters play into the hands of millions of foes in the sea, for it is not until the fourth or fifth stage that they leave the surface for the bottom. It is not until this period that caution seems to dawn in them and guide them to hiding places on the sea floor. In this care-free period vast schools of surface-feeding fish strain the water through which they chance to pass as effectively as might a towed net.

MESSMATES PRESENT THEMSELVES

Though only a few parasites of the Lobster are known, it has many messmates. Barnacles affix themselves to its shell and cement their tentlike coverings thereon; various kinds of Mussels insinuate themselves into attractive depressions in the carapace and joints. Tunicata sometimes fasten themselves on the undersurface of the body, between the legs. Tube-forming Annelida, lacelike Bryozoa, and various forms of algæ make themselves unbidden guests, which the uneasy host can cast off only when it molts.

Grain-eating birds swallow their food whole and, with the aid of gravel or other hard material, pulverize it in their gizzards. The Lobster handles the situation differently. It chews its food before passing it into its mouth. The cutting teeth of its outer mouth parts chop the material into mincemeat, which is passed into the mouth proper in a slow stream of fine particles. From there the food reaches the stomach, which is divided into two parts—the forward section for storage and the rear compartment for sorting, straining, and digesting the food. Between the two are three teeth, one upper and two lower, which, like upper and nether millstones, grind the food to its appropriate degree of fineness.

When one examines a Lobster carefully it is seen that the two great claws do not terminate alike. The one ends with a large crushing type of pincers and the other with a seizing type. One of the strange things in connection with these great claws is that Nature has given the Lobster power not only to amputate them in case of danger, but to grow others in their place after amputation occurs.

WHAT SELF-AMPUTATION MEANS

Imagine a man with his hand caught in a machine suddenly giving a severe jerk and severing his arm at the elbow! And then imagine him going off to himself and growing another arm to take the place of the lost one! That is comparable to what the Lobster does.

In a census of more than 700 Lobsters, 7 per cent were found to have thrown one or both great claws, and these showed every stage of the regenerative process. Nature has arranged matters so that no tendons or large blood vessels cross the breaking point, hence there is little bleeding at the operation.

That the self-amputation of the claw is a matter of will is shown by the fact that when put under an anæsthetic, the Lobster "forgets" to amputate the captive member.

GLUING HER EGGS FAST TO HER BODY

When the female Lobster lays her eggs she turns over on her back, using her large claws and her tail-fan as a tripod to support herself. She flexes her abdomen to make a sort of pocket, to which she glues the eggs fast. An 8-inch female will lay about 5,000 eggs, a 10-inch individual about 10,000, and a 19-inch one some 75,000, there being about 6,000 eggs to the ounce (see page 575).

The eggs are carried about for ten months. After hatching, the larvæ spend from three to five weeks irresponsibly floating around near the surface, somewhat lacking in the powers of coördina-

PACKING SARDINES IN CANADA

Sardine packing had an early origin on the Maine coast as a more lucrative outgrowth of the Herring industry. The quantity of canned fish has increased by leaps and bounds, Salmon ranking first and the Sardine second. The total value of canned fishery products was more than $46,000,000 in 1921.

tion and orientation. During this time they undergo four molts. At the third molt after hatching the Lobsters begin to take on the characteristics of the adult. At this stage the instinct to desert the surface and seek the bottom suddenly asserts itself, and the Lobsterling settles down to its new environment to eat and grow, reaching maturity in five or six years.

MANY MYSTERIES OF THE SEA

While the ocean literally teems with life, man has learned to make comparatively small use of it, and the list of fishes fit for food is infinitely longer than the list of food fishes. The things yet to be found out about marine creatures are vastly more numerous than the things already discovered.

Imagine a race living somewhere on table-lands towering above our atmosphere, and possessing craft lighter than swan's-down; and then imagine them launching out on the surface of the oceans of air, with clouds forever shutting out a view of the earth below.

Now and then one of their craft might drop a dredge. The sounding tube might sink into the soil of a cornfield or the mud of a river bank.

The dredge might capture a bumblebee

Photograph from Ewing Galloway

A FOUR-TON STACK OF FISH IN NOVA SCOTIA

In the northern regions of the earth where man must necessarily be frugal, no portion of fishes rich in oil, such for instance, as the Cod, is ever wasted. Norwegians mix Cod-heads in the food of their cows for the purpose of making them give richer milk. Icelanders give the bones of the Cod to their cattle, and the inhabitants of the Peninsula of Kamchatka give them to their dogs.

or a butterfly. It might conceivably get a field mouse or a pine cone. But, whatever it got, how little that would be compared with the vast number of things that would escape!

LIFE UNDER INCONCEIVABLE PRESSURE

And so it is with our knowledge of the sea and the vast numbers of creatures that inhabit its depths! Even on the floor of the deepest trench in the abysmal region of the sea's bottom, where no ray of light ever reaches, where Stygian darkness is perpetual, where all but freezing temperatures never cease, and where inconceivable pressures prevail, the miracle of life still goes on!

In some of the ocean depths the pressure exerted would be equal to that of a block of limestone three feet square and six feet high resting on a square inch of surface. A creature five feet long with an average girth of four feet would have to sustain a pressure of some 20,000 tons.

In size the denizens of the deep seas range from microscopic to mammoth creatures. Occasionally huge hulks of flesh of a tough, fibrous nature, unlike

Photograph by Edith S. Watson

FISHWIVES BEHEADING CAPELIN: ISLAND OF ST. PIERRE

The Islands of St. Pierre and Miquelon, ceded by Great Britain to France as shelters for her fishermen by the Treaty of Paris, 1763, are now only relics of the once great French empire in America. Both were formerly very valuable as stations from which France carried on her fisheries on the Banks of Newfoundland. St. Pierre is the smaller, but the more important of the two, and the little town of the same name presents a busy aspect during the fishing season. The American Capelin was so called because early French fishermen saw a resemblance to the European *Capelan,* a small Cod, but the American fish is classed as a Smelt.

that of any known creatures, are washed ashore. One such hulk was 20 feet long, 40 feet around, and weighed many tons. It was believed to be a fragment of some giant of the sea floor, torn loose by a cataclysm of the deep.

RELATIVE AREA AVAILABLE TO MARINE AND LAND FAUNA

The area of the sea is three times that of the land. Its average depth is more than two miles. The sea has 138 times as much territory 12,000 feet below sea-level as the land has 12,000 feet above.

While man and the terrestrial fauna are able to command only the surface of 57,000,000 square miles of land, the marine fauna has 140,000,000 square miles of sea, with scores, if not hundreds, of depth zones over most of this area, each with its own characteristic forms of life. The water level of the oceans would have to be lowered 10,000 feet to bring about an even division of the areas avail-

able for life of marine and terrestrial faunas.

With the great existing disproportion in area between the land and the sea, it is evident that the human race, with its seemingly insatiable mass appetite, will have to look more and more to the sea for its food.

THE RESULTS OF OVERFISHING

And yet on every hand one already sees the results of overfishing on many of the species now entering the fish markets.

The anadromous fishes, particularly the Shad and the Salmon, are growing scarcer and higher-priced with each passing year.

Between overfishing and stream pollution, the fresh and brackish coastal waters are seeing their fisheries depleted rapidly toward the vanishing point.

The Atlantic Salmon has disappeared from many rivers. Along the Maine coast the catch has dwindled to one-seventh of what it was in 1889. The Housatonic, the Thames, and the Saugatuck are Connecticut rivers that once were nationally famous for their Salmon, but which now yield none.

The Shad is going the way of the Salmon. The supply in the Potomac and the Susquehanna is gradually declining. In the Connecticut River the catch in 1923 was only one-tenth as large as that of 1903. The Hudson and the Merrimac know this fish no more.

Similarly alarming conditions occur among other species. The Smelt has disappeared from the Naugatuck, the Striped Bass from the lower Hudson and the East River. Twenty years ago as many Weakfish were caught off the northern New Jersey shore in a week as now are taken in a season.

The same condition prevails in the shellfish fisheries. Oysters are disappearing from beds where once they were plentiful in spite of Governmental and State watchfulness.

THE DECLINE OF THE LOBSTER FISHERY

The story of the constant yearly depletion of the Lobster fishery is told in every area where the fishery exists.

In colonial times Lobsters were so plentiful that even the poorest of the people might feast to their heart's content on this succulent crustacean.

Even as late as 1889 the catch in the United States reached a total of 30,000,000 pounds, which sold for $800,000—less than three cents a pound. Ten years later the catch was only half as large, while the price had more than doubled.

In 1880 Maine produced 14,234,000 pounds, which sold for less than two cents a pound, as compared with 5,545,000 pounds in 1922, which sold at 26 cents a pound at the wharf, and heaven only knows at how much to the ultimate consumer.

The catch of Maine alone, in 1880, was greater than the total catch from Delaware Bay to the Canadian shore in 1922.

THE EFFECT OF STREAM POLLUTION

Where stream pollution is the chief cause of the decline of the fisheries, nothing except radical protective legislation to save the streams will avail. The Government has found that a pound of bark to 30 gallons of water will kill Bass in one day, and that even a pound of chips to seven gallons of water is fatal to Salmon fry.

If such simple pollutions as these destroy fish by the wholesale, what destruction is wrought by oil and tar, sludge and bilge!

Overfishing may be combatted in two ways—by artificial propagation and by restricting the catch, either as to season or as to size—in short, applying common sense.

Artificial propagation has proved its value in the case of fresh-water and anadromous fishes. The Shad fishery continues only because the U. S. Bureau of Fisheries has preserved it by artificial propagation. The same is true of the Salmon.

THE "DANGEROUS AGE" IN FISHES

But for marine fishes, authorities differ as to the value of methods at present employed. As new knowledge of the sea is gathered, however, there come reasons to believe that conditions may be established under which artificial propagation can be made a success.

It has been found lately that there is a dangerous age for the fry of fish, just as there is for the children of men. We

A GOOD CATCH IN NOVA SCOTIA

Of the myriad forms of fish life, one of the largest groups is that of the bassalian, or deep-sea fishes, which includes those that live below the line of adequate light. Since they dwell below the influence of the sun's rays, climatic zones and surface temperatures have little relation to them, and the same forms are to be found in the Arctic as under the Equator. These deep-sea fishes are held to be adaptations of forms that once lived close to shore.

HANDLING TUNA: ST. MARGARETS BAY, NOVA SCOTIA

A giant fish being hoisted from the spiller net after it had been killed. Specially constructed boats are used because of the great weights of the Tuna. Before the kill, great care must be used in handling it, since its wide, sinewy, V-shaped tail could crush or capsize a boat.

Photograph by Arnold L. Belcher

PART OF THE FISHING FLEET AT ANCHOR NEAR THE CUSTOMHOUSE TOWER, BOSTON, MASSACHUSETTS

These mosquito craft are a part of the great fishing fleet which landed over 14,000,000 pounds of fishery products on the wharves of the Nation's fishing capital during one representative month in 1922. Distribution of sea food passing through Boston is confined chiefly to Massachusetts and neighboring States, Massachusetts' consumption exceeding one and one-half pounds per capita monthly.

know that more children die between the day of their birth and their second birthday than during the next twenty years, because of the high mortality from diseases of infancy.

Likewise, it has been demonstrated that the first few weeks of a fishling's career constitute a high mortality period, in which thousands die where one survives.

If safe artificial methods could be devised to bring the fry past the critical period, their chances of survival would be vastly improved. It has been found that usually this period of wholesale decimation is reached about the time of the absorption of the yolk sac.

PLANKTON AND ITS RELATION TO FISH LIFE

Apparently at or before this stage minute forms of plankton—the mass of

© Ewing Galloway

WITH LOAVES AND FISHES HE FEEDS HUNGRY HUNDREDS IN NEW YORK CITY

Down near Fulton Market, in New York City, once a week a truckman gives large quantities of fish and bread to women from very poor homes in the vicinity. This picture shows the distributor and his assistant supplying a long line of women and children waiting beneath the shadows of some of the city's largest financial institutions.

passively floating or weakly swimming plant and animal life near the surface of the sea—are needed as food by the fry that can no longer draw on the yolk sac for nourishment, and without this plankton they die.

The scarcity or abundance of plankton has been found to depend upon sunlight and temperature, and the examination of the scales of fish reveals that in any school of adults there is a great preponderance of some particular age. Figuring back, this class coincides with the year most favorable to the development of plankton.

This affords a clue to the discovery of a method by which marine hatcheries may bring their salt-water fry past the dangerous age before releasing them—a thing that cannot now be done.

This line of investigation shows how important the study of marine life is, what invaluable revelations it may yield, and the splendid character of the results that may be attained therefrom.

The United States Bureau of Fisheries

Photograph by Gilbert Grosvenor

LANDING GIANT TUNA FISH, CAPE BRETON ISLAND

The North Atlantic Tuna is the giant of his tribe, specimens weighing as much as 1,500 pounds having been captured. European varieties do not attain more than 500 pounds, and on the California coast they are still smaller. In the Old World the Tuna has been prized as food since the time of the ancient Romans, but it was long in gaining popularity in this country. The American canned Tuna industry is comparatively new.

has recently published a paper on the Lobster which shows how an understanding of marine life leads to a solution of the problem of its conservation.

SAVING THE LOBSTER FISHERY

To meet the alarming decline of the Lobster fishery, the several States interested in its protection have enacted various laws. Some have provisions for a closed season, in which the taking of this crustacean is forbidden. Laws prohibiting the destruction of female Lobsters "in berry"—that is, carrying their eggs after laying them—have also been enacted.

In addition to the protection thus offered, attempts have been made to propagate them artificially, by hatching and liberating the fry.

Existing policies, however, have not checked the decline, and recent studies show that new forms of protection and propagation must be adopted if the fishery is to be saved. Dr. Herrick, America's foremost student of the Lobster problem, proposes the abolition of the closed season, which he considers a futile practice. He would adopt a double gauge, under which traps would be prohibited that did not permit the escape of all Lobsters under 9 inches, and make impossible the entrance of all over 11 inches. He also would forbid the capture or sale of all below or above that limit; would protect the "berried" Lobster and fix a bounty for each one delivered to the fishery authorities. He would have young Lobsters reared to the bottom-seeking stage in hatcheries, thus liberating them when the perils of infancy are past.

FISHES OF GEOLOGIC HISTORY

Jordan observes that when a fish dies it leaves no friends. Its body is promptly attacked by scores of scavengers, ranging from the one-celled Protozoa and bacteria to members of its own species. The flesh

is soon devoured, the gelatinous substance of the bones decays and leaves the phosphate of lime content to be absorbed by the water. Hence the multitudes die without leaving any trace behind. Once in a great while a few teeth, or a fin spine, or a bone buried in clay may endure, but the exceptions are notably rare.

It is because of this condition that few traces of the earliest fishes of the geologic past have been left. An expedition from the Smithsonian Institution, some years ago, unearthed, near Cañon City, Colorado, what are believed to be the oldest fish remains known to science. They come down from the Lower Silurian age, a time when neither man nor mammal, nor reptile, nor any other living land animal with a backbone, had yet appeared—a time, indeed, when some of the deepest sandstones we know were being laid down.

FORCES OF DISTRIBUTION STILL AT WORK

From early geologic times many things have played important rôles in determining the distribution of the various species of fish. We see those same forces at work to-day.

In New England waters only a beggarly 34,000 pounds of Bluefish are taken annually, while from there to Delaware Bay the yearly catch amounts to more than 3,000,000 pounds.

In the case of Cod, the situation is reversed, there being some eighty times as many Cod taken north of Long Island as south of that latitude.

There are practically no Croakers in New England, but a plentiful supply off the New Jersey shore.

There are few Herring in waters between Long Island Sound and Delaware Bay, while the Menhaden are most abundant there. Temperature is regarded as the principal influence in thus separating the fishes in these two parts of our North Atlantic waters. There are some species that seem to be equally at home above or below the latitude of Long Island, such as the Alewife, the Butter-fish, the Summer Flounder, and the Scup.

BOSTON, CENTER OF AMERICA'S FISHERIES

Boston is easily the fishing capital of the New World, and yields only to Grimsby, England, as the world's leading fishing port (see illustrations, pages 582 and 590).

In the North Atlantic fisheries, Canada has 43,000 men employed, as against 76,000 for New England and the Middle Atlantic States.

In the United States fisheries north of Delaware Bay, the Menhaden takes first rank in the weight of the catch, with 256,000,000 pounds to its credit.

There is a wide gap between it and the next group, which includes the Herring, Haddock and Cod, with 98,000,000, 89,000,000, and 86,000,000 pounds, respectively, as the weights of their annual catches.

Then there is another wide gap, followed by another group, which includes the Pollock, with 25,000,000 pounds; the Flounder, with 22,000,000; the Hake, with 21,000,000; and the Whiting, with 20,000,000 pounds.

The Mackerel leads the fourth group with 17,000,000 pounds, the Weakfish and the Scup following second and third.

The Alewives head the group of four next in importance, with 5,000,000 pounds. The Butter-fish, the Croaker, and the Bluefish contribute 4,600,000 pounds, 4,236,000 pounds, and 3,362,000 pounds, respectively, to the total catch.

The Cusk and the Bonito are the other species that show an annual catch of more than 2,000,000 pounds.

THE ERA OF CHOICE FOODS

The Lobster fishery yields over 12,000,000 pounds, nearly half of the product being taken from the Lobster pots of Maine.

The abounding wealth of the United States and the high per capita income of the people have made them able to indulge their whims rather than their needs for food. Therefore the food they select, both from land and sea, has been chosen more from the standpoint of flavor than from that of nourishing qualities. The choice cuts of beef and the choice varieties of fish are taken and the remainder all but discarded.

They have been particularly slow to adopt new salt-water fishes into their diet. What was ignored yesterday comes into the market to-day, and to-morrow it acquires a vogue.

It is not so long ago that the Pollock

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AN ATLANTIC FISHERMAN MENDING HIS NETS

The gear with which the ocean fishermen comb the seas for food for man is of many kinds and of divers types. The capital invested in the fishing fleets of the North Atlantic is in the neighborhood of $100,000,000.

was in such small demand that it was scarcely worth the taking. So also with the Tuna. But to-day both find ready sale, the latter particularly in cans.

The Flounder, likewise, used to be eaten only by the initiated few; but now it is one of the most ready sellers. So it has been with the Haddock and the minor Salmons.

TRAINING THE NATIONAL TASTE

Sea Mussels and Tilefish (see Color Plate XV) show how the public taste can be trained under proper guidance, and as the population of the country grows we shall follow Europe in the utilization of marine resources to supplement our land crops. To-day we eat only about a third as much fish per capita as the people of Europe, and have only scratched the surface in promoting the utilization of our food-fish resources.

We have overfished a few of our species, but the great majority have barely been touched. Even those which constitute our principal fisheries are yielding, with a few exceptions, only a fraction of what they could offer, if marketing facilities were better.

Three basic handicaps—perishability of the product, unevenness or uncertainty of supply, and unsteady consumer demand—have kept the fresh-fish industry from developing as it should.

FRESH FISH TO EVERY MARKET

Other products have one or two of these handicaps: milk is perishable, but considered imperative; canned goods have an uneven demand and supply, but only fish suffer from all three conditions.

But lately ways are being discovered to overcome the perishability of fish. Methods of precooling have been found in which the fish can be frozen as soon as taken, in low-temperatured brine, insuring the thorough cooling of every shred before chemical change sets in.

Then the fish is encased in an individual film of ice and sent to market. The housewife who buys her fish in this ice jacket can then know it is perfectly fresh, having been kept so from the hour it was caught.

A fresh fish bought in a market stall is seldom as fresh as a frozen fish precooled when caught, and once this type of frozen fish becomes widely available, it is safe to predict that the zone in which marine fishes are eaten fresh will reach much farther back from the coast than it now does.

Other methods of securing new patrons of the marine fisheries have been tried with success. Last winter two Boston wholesale fish dealers tried putting up choice cuts of Haddock in consumer packages wrapped in parchment paper. The experiment was so successful that these packages have found favor as far away as Denver.

A Boston forwarder took a step in another direction in the extension of the fresh-fish market. He undertook to gather the less-than-carload lots of fish consigned to Philadelphia or other cities and to ship them through in carload lots with a large saving of transportation costs and increased expedition in handling.

SHIPPING LIVE FISH TO MARKET

A Canadian fisherman has tried shipping live Lake Trout to New York, with striking success. He sent in one shipment 6,000 pounds of Trout. They were put in four wooden tanks seven feet square and five feet deep, which were placed in an ordinary box car. By means of a kerosene-driven engine the water was kept constantly in circulation. Casualties in transportation were only about 15 per cent, and it is possible that in the future the fastidious can enter their favorite restaurants, peer into a pool, and select the fishes they want to eat—that is, if the demand is great enough to warrant the regular deliveries.

That fish from the sea will help solve the food problem of America whenever it becomes acute is shown by the fact that analyses reveal how readily fish can be used as a substitute for meat.

Fresh Salmon has more nutrients in it, for instance, than round steak; Shad, more than chicken.

THE DAY OF FISH FARMING

There are some six million farms in the United States, and as the demand for food grows more pressing, each will probably have its own fish pond. Assuming that each farm will utilize only three pounds of fish a week, a total of more than a billion pounds would be available,

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BUYERS MATCHING FINGERS IN THE DIVISION OF BARRELS OF FISH AMONG THEM

"Mora," or finger matching, is a very old Italian game. It is played either for wagers or for fun and the Italians are very skillful at it. Shore Haddock, landed only a few hours after being caught, enjoy an eager demand at twice the price of offshore Haddock.

releasing a nearly equivalent amount of other meat for urban consumption.

The United States Bureau of Fisheries has foreseen the day when exact knowledge of the marine and fresh-water conditions that make for an abundant fish supply will be one of our major concerns.

It recognizes that without exact and definite knowledge of all phases of marine biology that affect the lives of the fishes suitable for human consumption, efforts to utilize the food resources of the sea to the fullest advantage must be handicapped so sorely that species which might render rich returns will be neglected, while others that have met with great favor may be all but exterminated.

The Bureau's work in introducing the Shad into Pacific waters and making it abundant through 2,000 miles of coastline has been a service of the first order. Its success in saving the Atlantic Salmon and the Shad from extermination in such eastern rivers as have not reached the critical stage of pollution is another instance of its unusual value to the nation. Its rescue of the Seal fishery from destruction and its protection of the Alaskan Salmon fishery from inordinate depletion have earned for it a universal appreciation.

Yet these activities are but a prelude to the things that remain to be done.

Thanks to the splendid achievements of the past, in which such men as Goode, Jordan, Evermann, Nichols, Gudger, Bigelow, Barbour, Parker, Eigermann, Townsend, and numerous others have rendered an inestimable service to humanity by their gradual pushing back of the horizon of marine life, ichthyology to-day stands at a point where a correct appraisal has been made possible of the problems remaining to be solved in order to develop for an ever-expanding race all the potential treasures of the sea.

SALT WATER GAME FISHES

It is an interesting coincidence that most of the game fishes of salt water

habitat belong to those species that are favorites as food fishes. The lure of the Trout stream and Bass-abounding waters, and the fascination of pursuing the Pickerel and the Muskellunge, the Pike and the Grayling, have brought thrills to millions who have cast a line in fresh water.

But the man who originated salt-water fishing with rod and reel, where the sport really begins when the game is hooked, where hours of battle are often required to bring the valiant fighter to gaff—hours in which the crown of victory trembles in the balance between fish and fisherman—that man created a sport which is the last word as a contest of human skill and piscatorial gameness.

Angling with rod and reel for salt-water fishes is of comparatively recent origin, but when done "according to Hoyle" it makes the battle between fish and man a fight that gives the fish an even chance, and can be won by the fisherman only through the exercise of his last reserve of skill.

The Tuna, the Black Sea Bass, the Weakfish, the Striped Bass, the Bluefish, the Tautog, and the Sheepshead all offer sport with as many thrills as Tarpon fishing affords, when each is caught with the tackle prescribed by sportsmen's associations for battle with the respective species.

"THE LION, TIGER, AND ELEPHANT TRINITY"

One authority has called the Tarpon, Tuna, and Black Sea Bass the lion, tiger, and elephant trinity of the angling world. Yet the game is bringing them to gaff with seven-foot rods, weighing not more than 25 ounces, although there may be from 100 to even 400 pounds of game and fighting fish at the other end of the line!

It is a battle royal when one of these resourceful and unrelenting denizens of the deep is well hooked by a successful strike, and reel wars against fin—a battle that the novice is almost certain to lose, and that even the veteran of many victories cannot count as won until the gaff has done its work.

The Tuna is an inhabitant of many seas. In North Atlantic waters it is known as the Horse Mackerel, in the North Sea as the Tunny, in the Mediterranean sometimes as the Great Albacore, and in California and southern Florida waters as the Tuna.

In the vicinity of Santa Catalina, California, Tuna angling has reached its high-water mark as a sport. The angling ground is a narrow, four-mile stretch of coast in the lee of the island mountains, where there are several small open bays, generally smooth, with wind blowing only a part of the day. The vicinity of Miami Beach, Florida, is also a favorite hunting ground.

THE TACKLE FOR TUNA

Such a fine fighter needs special tackle, if it is to be taken in true sportsman's style, and if that tackle isn't the best that ingenuity can devise and money can buy, it is safe to wager long odds that the prize will not be landed.

Once a successful strike has been made, the game is to bring the quarry to the boatside with rod and reel. A little too rigid holding of the rod, a momentary failure to keep the line taut, a little lapse of skill in the manipulation of the reel—in short, any one of a dozen kinds of mishaps and the battle is lost or begun again.

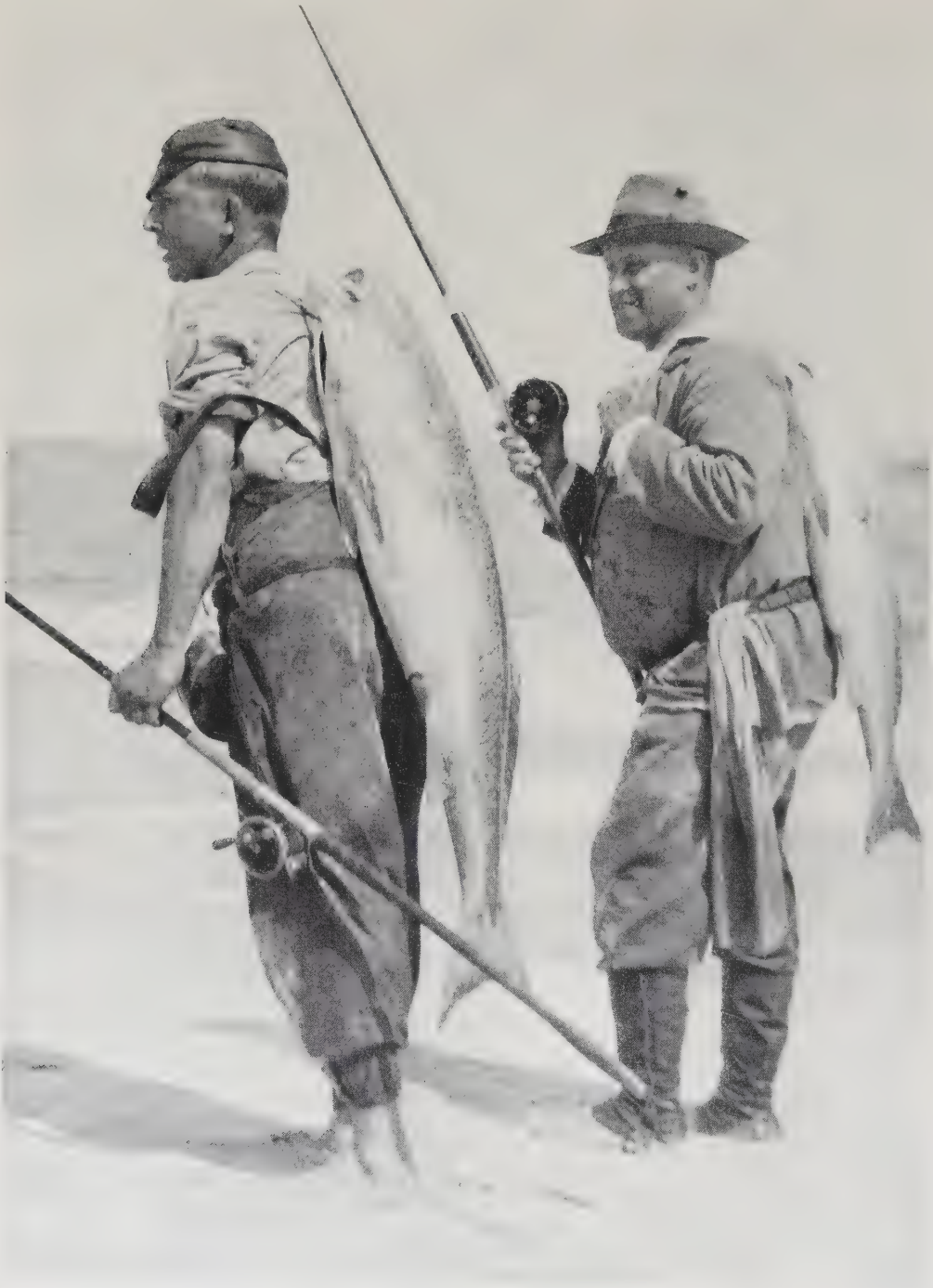
Special boats are required for Tuna fishing as a sport. They are broad-beamed launches, built for two fishermen and the boatman, who serves as engineer, helmsman, and gaffer. Usually each boat is equipped with a three- or five-horse-power gasoline engine.

Then the fun really begins in earnest. Leaping into the air, running hither and yon, diving, darting, and fighting every inch of the way, the great fish gives battle. Often it lasts for hours; sometimes the fight ranges over a ten-mile sector.

There are 300 feet of No. 24 Cuttyhunk line to be fought over by man and fish. Now reeling it in to bring the fighting quarry toward the gaff, now playing it out to prevent a jerk that might part it, the battle rages until triumph comes to the sportsman or victory to the fish.

In California Flying Fish is the bait on which the Tuna strikes best. The latter come in large schools between the middle of May and the last of June, and at once divide into companies of from fifty to a hundred.

For awhile they play around on the surface; then suddenly there is a great splash and the fretted waters turn into a



Photograph by H. Armstrong Roberts

TWO SALT-WATER GAME FISHERMEN WITH THEIR PRIZES OF A DAY

These two Channel Bass, one weighing 47 pounds and the other 23, show the possibilities of sport with rod and reel in sea fishing. He who gets a game fish weighing from 40 to 200 pounds on a hook becomes a party to a battle royal in which man and fish may struggle for hours, with victory trembling in the balance all the while and the issue undecided until the very last moment (see text, page 601).

Photograph by H. Armstrong Roberts

LANDING A SIX-POUND WEAKFISH, OR SQUETEAGUE, IN BARNEGAT BAY, NEW JERSEY

The Weakfish did not get its name from any lack of gameness, but rather from the softness of its mouth parts. At the end of a line and rod of sportsmanlike proportions it can give the fisherman who hooks it a battle that calls for all the resources of skill to bring it to the landing net (see text, page 601).

boiling spray; the Tunas have sighted a school of Flying Fish, which skim along in frenzy and wild confusion from their natural enemies. That is the signal for which the fishermen have been waiting, and the sport is on.

TARPON THE EASTERN RIVAL OF THE TUNA

The Tarpon is not classed as a food fish, but it is to Atlantic waters all that the Tuna is to Pacific, the acme in sea sport fishing.

The credit for originating the sport of Tarpon fishing belongs to William S. Jones, of Philadelphia. Back in the late eighties he was fishing in the Indian River Inlet, in Florida, and chanced to hook a 130-pound Tarpon, which was six feet long. For two hours he battled with his quarry and finally brought it to gaff.

Wherever fishermen forgathered in that day, the story of Jones' triumph was told, and soon Jupiter Inlet became the mecca of the Nation's rod and reel champions. To-day Tarpon fishing is an established sport at many resorts in southern Florida, both on the Gulf side and in the Atlantic, and clubs strictly regulate the character

Photograph from Bureau of Fisheries

FISH HATCHERY EXPERTS REMOVING EGGS AND MILT FROM FISHES FOR ARTIFICIAL PROPAGATION PURPOSES

of tackle to be used to a point where only skill can win.

The vast schools of Mullet upon which the Tarpon preys form the magnet that draws him to the various feeding grounds in Gulf and Florida waters.

Ordinarily one does not think of the Weakfish, or Squeteague, as offering much in the way of sport, but when angled for with appropriate tackle, it can give the fisherman thrills that leave nothing to be desired.

Its abundance and willingness to bite make it popular with anglers who want action. It is a handsome member of the finny tribe. The Cape Cod fishermen call it the "drummer" because of the peculiar noise it makes when traveling in schools. It gets its name "Weakfish" not because of its lack either of gameness or stamina, but because the bony processes of its mouth are soft and tender.

There is never a doubt when a Weakfish bites. It simply swoops down on the bait and is off with it like a flash. Its soft mouth-parts call for skill in bringing it in. A sudden jerk will tear out the hook, hence the line must always be taut, and the fish must be led in rather than dragged. Rods weighing from ten to fifteen ounces, made of greenheart or bamboo, are prescribed for Weakfish angling, and a fine linen line 300 feet long, with a multiplying reel, is employed.

THE STRIPED BASS AS A FIGHTER

All anglers agree that the fisherman who hooks a Striped Bass with proper tackle has a run for his money. Once hooked, this flashing fighter does not spend its time leaping out of the water, trying to shake the line loose, as does the Salmon.

Rather it makes a first fierce plunge and brings every ounce of its muscular fiber to bear against the line. If this is strong enough to hold it in leash, it seeks to free itself by finesse and strategy. Now it tries to chafe the line over the sharp edge of the rocks to which it runs; failing in that, the fighter will attempt to foul the line in seaweed and kelp.

But if it be of good size and the rod of about 18-ounce weight, with a 12- or 18-thread Cuttyhunk line and a quadruple multiplier reel, it will give the disciple of the Izaak Walton League who hooks it a lively and artistic tussle before throwing up the sponge.

Loving brackish water, the Striped Bass brings the sport of philosophers a considerable distance inland. Roanoke and Potomac rivers, the Raritan and the Passaic, and numerous others afford excellent fishing grounds for Striped Bass.

It is a temperamental fish, shy to a degree at times, now taking one bait and now responding to another. Small Eels, Shrimps, Crabs, and blood worms are to its particular liking.

THE GAME AND GAUDY BLUEFISH

Usually we think of the Bluefish as one of the dependables of the bill of fare; but it has some exciting moments to offer the angler who prefers the rod and reel of the sportsman to the hand line of the pot fisherman.

With a spanking breeze and a moderate sea, the man who hooks a Bluefish earns his dinner. It makes a smashing fight, and the fisherman who lacks the skill of giving proper tautness to his line is likely to find it broken by a sudden rush or shaken loose if allowed to slack.

Though the leader may be of wire, the fish will attempt to swim ahead and bite the line in two with its sharp teeth.

One angler has described the hooked Bluefish as a wild tiger, with all its strength and courage and deviltry—now running deep, now rushing from side to side, but always pulling and jerking with its entire strength in its mad battle for freedom—a foeman worthy of any one's steel.

Lobster tail, shedder Crabs, live Killies or small Herrings are tempting tidbits to the voracious Bluefish, which has been called the glutton of the deep.

It is related that Bluefishes are utterly wanton in their gluttony and will prey on a school of lesser fish until their stomachs are so full that they disgorge the harvest and begin all over again.

The Bluefish, like the Striped Bass, brings the joy of salt-water game fishing into many of the Atlantic coast rivers, notably the Hudson, the lower Potomac, and Hampton Roads.

Some of the deep-water food fishes offer good sport for the fishermen who go down to the sea in boats to cast their lines. One of these is the Sea Bass, a

© Boston Photo News Company

"THE BREAKER," AN ICE-COVERED TRAWLER JUST IN FROM A TRIP TO THE FISHING GROUNDS, AT THE FISH PIER, BOSTON

rather sluggish citizen of the sea, but withal a ready biter and interesting game for those people who like to go out on an excursion steamer that drops anchor on the banks off Sandy Hook, for instance.

Sometimes the Black Sea Bass breaks water like its river cousin, and makes vicious leaps and contortions in its efforts to free itself; but its jaws are leathery and once well hooked it seldom gets away. An eight-ounce rod is the rule for sportsmen angling for the Sea Bass.

All hands pay tribute to the Kingfish as perhaps the gamest for its size of all the bottom-feeding denizens of salt water. Famous alike for its qualities, its splendid color, its graceful form, and its fine flavor, it was christened the Kingfish by the *bons vivants* of Colonial days, when New York was yet New Amsterdam. It takes bait readily, Clams, bits of fish, shedder Crabs, sandworms, and Shrimps being to its liking. Its tactics when hooked are largely those of the Smallmouthed Bass. In surf fishing the best time to catch the Kingfish is the first of the flood tide.

The treasures of the sea are many, but none is more certain to yield delight to the true sportsman than the game fishes that disport in its waters. The commercial fisherman, with his seines and hand lines, is perennially harvesting boatloads of sea fish for a large consuming public; but the real joy of the ocean is reserved for those with rods and lines properly designed to put the fisherman and his prize on even terms, where human skill and piscatorial generalship can each have its innings and the issue remains in doubt to the climax.

POLLOCK (Pollachius virens)

(For illustration see Color Plate I)

The Pollock, also known as the Green Cod, or Coalfish, has a range that reaches across the Atlantic and as far south as Cape Henry, although it is not taken in commercial quantities south of New Jersey. In size it attains a weight of 35 pounds and a length of 4 feet. It is a voracious eater and very destructive of young Cod. A ready biter, many sportsmen regard it as a fine game fish for rod and reel.

Though a bottom-feeder, the Pollock frequents the surface and intermediate depths. It congregates in large schools, roams from place to place, and preys on all kinds of young fish. Professor Sars tells of witnessing an attack by a Pollock school on a school of small Cod. The latter were completely surrounded and driven into a compact mass. On the edge of the mass the Pollocks bored in, eating their voracious way, while from above the screeching sea gulls plunged down to share the feast. In dire panic the young Cods darted this way and that and broke through the line as best they could.

The Pollock appear about Cape Cod early in May, passing Race Point so close inshore that they are often caught with seines on the "tide rips." A favorite spawning ground is off Cape Ann, where they stay from early May to late January, and by October get so numerous at times that they annoy the Cod fishermen by taking the bait before it has time to sink to Cod depth.

The liver of the Pollock is particularly rich in oil, the medicinal quality of which is not inferior to cod-liver oil. The Pollock, like the Haddock, is rarely salted.

CODFISH (Gadus callarias)

(For illustration see Color Plate I)

The Codfish belongs to a family which comprises many species, including some of our most valuable marine fishes. The principal species are the Cod, Haddock, Pollock, Hake, and Cusk.

Until recent years the annual value of the Cod has exceeded that of its close relatives, but during the past decade the Haddock fisheries have on several occasions assumed the first rank. The Cod owes its value as a food fish to its flavor, size, comparatively few bones, year-round abundance, and adaptability to dry-salting. Fishes rich in oil cannot be successfully dry-salted, and for this reason such species as the Salmon, Bluefish, and Mackerel, if salted at all, must be put into brine.

The Cod is a cold-water fish and its movements are largely governed by changes in the water temperature. However, the temperature in many parts of the North Atlantic is so low throughout the year that the Codfish may be caught in equal abundance the year round. It is generally taken at depths of from 8 to 40 fathoms, but is known to inhabit much deeper water. It is found on our Atlantic coast from Cape Hatteras northward and is also an important species on the European coast. It is taken in commercial quantities in all our Atlantic States from New Jersey northward. Along the New Jersey coast it is found from late November until early May, but off the New England coast and the offshore "banks" it is caught throughout the year.

The Cod is taken with otter trawls, trawl lines, hand lines, and gill nets. The larger vessels employ the otter trawls and are known as "trawlers." Hand lines and trawl lines are the most popular methods of fishing, as their use requires only a small boat and crew. The boats range in size from the small motor and sail type to the large steam trawlers. Nearly all boats now carry engines, and thus are better equipped to encounter the frequent fogs and the violent storms which appear almost without warning, and which were the bane of fishermen of former days.

The Cod is an omnivorous feeder, eating almost anything it happens upon. Its chief food appears to be Mollusks, crustaceans, worms, and fish, but articles such as jewelry, glass, stones, leather, etc., have been found in its stomach. Its omnivorous habit is responsible for the finding in its stomach of rare fishes and shells that otherwise might not have been known to exist.

Spawning takes place along the New England coast from October to June. The eggs are about one-nineteenth of an inch in diameter and since they float at the surface, many are cast ashore, eaten by birds, or otherwise destroyed. To offset this great destruction, Nature has rendered the Cod very prolific and a good-sized fish may contain several million eggs.

The largest Cod recorded was more than 6 feet long and weighed 211½ pounds, but fish weighing more than 75 pounds are comparatively rare. The usual size of those taken on the banks ranges between 10 and 35 pounds. The Cod is not a game fish, but when hooked by an angler is a welcome addition to his catch.

It is said that the Cod fisheries constituted one of the inducements that led England to establish colonies in America. Their early importance was so great that the Cod won a place on the seal of the Colony of Massachusetts, and in the Massachusetts State House it is honored with an image. The Cod has been portrayed on Nova Scotian bank notes with the legend "Success to the Fisheries," and on the early postage stamps of Newfoundland, where the courts have held that whenever the word "fish" is unqualified it must be taken to mean Codfish.

HADDOCK (Melanogrammus æglifinus)

(For illustration see Color Plate I)

The Haddock is close to the Cod both in appearance and in its quality as food. It may be known at sight by the characteristic black lateral line that reaches from gill to tail. The "Finnan Haddie" of commerce, which is said to take its name from Findon or Findhorn, both towns in Scotland, is smoked Haddock. Unlike the Cod, the Haddock is seldom salted.

On the American coast the Haddock rarely

Photograph by Edith S. Watson

SPREADING CODFISH FOR DRYING

The banks on which the American Cod fishery is located cover an area of approximately 60,000 square miles, stretching in a southeasterly direction from the Newfoundland coast toward the center of the Atlantic Ocean. The depths in which the fishing is carried on range from 60 feet on the crest of the banks to 800 feet on their lower slopes. When a vessel goes out to the fishing grounds it usually carries some 400 hogsheads of salt and from 7 to 12 tons of bait, mostly frozen Squid and Herring.

Photograph by Franklin L. Fisher

LANDING MACKEREL AT NEW BEDFORD, MASSACHUSETTS

Thanks to its habits of moving in schools, the Mackerel falls easy prey to all the larger predaceous sea creatures, particularly Sharks, Dogfish, Tuna, Bonito, and Bluefish. The mystery of its migrations still awaits solution.

is encountered north of the Straits of Belle Isle or south of Hatteras. On European shores its habitat extends from Icelandic waters to those of France and entirely surrounds the British Isles.

More gregarious than the Cod, the Haddock swims in large, compact schools in its migrations from place to place. It is a bottom-feeder and has marine invertebrates for its principal diet, Mollusks seeming to be favored above everything else. The spawning season of the Haddock is from April to June. The average size of those caught is from 2 to 4 pounds, with 17 pounds as about the maximum.

In recent years the catch of Haddock has been so large as to make it a rival of the Cod, which it has occasionally outranked in the annual value of the catch.

WINTER FLOUNDER (Pseudopleuronectes americanus), and SUMMER FLOUNDER (Paralichthys dentatus)

(For illustration see Color Plate II)

The Flounder family includes the Halibuts, the Flounders, and the Turbots. The Winter Flounder (*Pseudopleuronectes americanus*) belongs to the Flounder tribe and is an important food fish on the New England coast. Next to the Halibut, it is the most widely caught Flatfish in Atlantic waters, and ranges from Labrador to Hatteras, being especially abundant on the Massachusetts and Connecticut shores. It is not a large species, seldom attaining to more than 20 inches in length and 5 pounds in weight. A large female produces as many as a million eggs, the spawning season being from February to April. This species feeds on shellfish, young Crabs, and similar foods. It is a favorite with many anglers, being one of the few shore fish that can be caught during late winter. In the vicinity of New York hundreds of anglers may be seen fishing for Flounders on favorable days during March and April.

The Summer Flounder (*Paralichthys dentatus*) or Plaice, also highly regarded as a food fish, is in some quarters known as the Fluke. It is distinguished from the Winter Flounder by having a large mouth, whereas the other has a very small one. It averages in size from two to eight pounds and compares with the Turbot and the Brill of the English coast. The largest one recorded weighed 19½ pounds.

The Summer Flounders, like the Winter species, habitually live on the bottom, where their shape and color camouflage them and give them opportunity to catch their prey. They are found mostly in bays, on sandy, muddy, or rocky bottoms. Feeding on small fishes, Crabs, Shrimps, and Squids, they frequently come to the surface in pursuit of their prey.

The migration of the eye in Flounders is one of the strange provisions of Nature for the protection of the Flatfish tribe. In early youth the Flounders swim about normally, with their eyes symmetrically placed; but as the

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WEIGHING AND BOXING SHAD FOR MARKET

The Shad is one of our most important fishes commercially, about fifty million pounds being sold annually. It has long been decreasing in numbers, due to overfishing and to the ever-increasing pollution of the rivers in which it spawns.

fishes develop they lie flat in the sand, some species on one side and some on the other, and the right eye migrates over to the left side, or vice versa, so that they ultimately have both eyes on one side of their heads.

HALIBUT (Hippoglossus hippoglossus)

(For illustration see Color Plate III)

The Halibut is the largest fish of the Flounder family and one of the most widespread in its range. It claims all seas for its habitat, in regions north of Havre, New York, and San Francisco.

A strange fact concerning this and other cold-water species is that they have eyes and color on the right side, while species inhabiting warm water have eyes and color on the left side.

The Halibut usually frequents offshore banks and exists in great numbers in many localities, but is sought after with such eagerness that it is gradually decreasing in numbers. It grows to a large size and fish weighing 200 or 300 pounds are often taken. The record weight was established when in June, 1917, the *Eva Avina,* fishing 50 miles off Thatcher Island, Massachusetts, caught a Halibut 9 feet 2 inches long and 4 feet 2 inches broad, weighing 625 pounds dressed.

The seaward movement of the Halibut has been noted by American fishermen. When the taking of Halibut first began, it was most abundant on Georges Banks. Later it gradually disappeared from those banks and went farther out to sea. It is now found mostly in the deep gullies between the offshore banks and on the outer edges of those banks, in water 100 to 350 fathoms deep.

A voracious eater, the Halibut feeds upon the Skate, Cod, Haddock, Menhaden, Mackerel,

Photograph by Press Illustrating Service

CLEANING FISH IN QUAINT ST. JOHN'S, NEWFOUNDLAND

Many men spend practically their entire lives as fish cleaners. Even in so humble a trade rivalries crop out, and there are a number of claimants for the international championship in fish dressing.

Herring, Lobster, Cusk, etc. Crabs and Mollusks are also to its liking. Instances are recorded where it has attacked Codfish and stunned them by the flip of its tail. One was so busy putting a big Cod *hors de combat* that it allowed a dory to steal up and capture it before it had become aware of its peril.

The female Halibut becomes heavy with roe in July and August, and instances have occurred where such a large quantity was taken from one of them that a good-sized man could scarcely carry it.

COMMON STURGEON (Acipenser sturio)

(*For illustration see Color Plate IV*)

The Common Sturgeon has a maximum length of about 10 feet and sometimes reaches a weight of 500 pounds. Its range is from the Carolinas to Maine, but the region of its greatest abundance is the Delaware River. It is a migratory fish, spends most of its time near the shore, and then runs to brackish or fresh water to spawn.

Considerable change in the Sturgeon's appearance takes place as it grows older. The young have more slender and protuberant snouts than their elders. The sexes also differ, in that the male has an oblong head, with a wide, blunt snout, while the female's head is triangular, rapidly narrowing from the back to the snout.

A bottom-feeder, the presence of Mussel and other shell fragments in its stomach, as well as of mud containing the remains of small crustaceans, tells of its habit of scooping its dinner from the floor of the sea. The barbels and lips are sensitive in the detection of food, but the snout is used to root up the soft bottom of shoal places in search of something to eat.

FISHERMEN UNLOADING THEIR HERRING AT A LOCKEPORT CANNERY: NOVA SCOTIA

The Herring family is large and prosperous. It includes such diverse members as the Shad, the Pilchard, the Anchovy, the Sprat, and the Whitebait. All branches of the family have small mouths and either have no teeth at all or very small ones. They are therefore, for the most part, obliged to find sustenance in the myriad of minute animals diffused through the waters of the ocean or lurking among the weeds at the bottom.

Goode assures us that this fish is prone to jump out of the water at an angle and may project its body for some distance. It is so active that it sometimes leaps into small boats. One is reported to have leaped high enough above the water to jump through one of the "dead-lights," near the water's edge, of the hull of a passing side-wheel steamer, and thus to have made itself prisoner.

The spawning season is somewhat regulated by the temperature of the water on the spawning grounds. May is the usual month in the Delaware, and the latter half predominantly so. The spawning fishes, known as "runners," are usually most abundant after the middle of the schooling period. They seek a hard bottom in which to deposit their eggs. The spent females are of little value for the time being, but later they become sleek and fat, and as "cowfishes" their flesh is in prime condition.

The eggs of the Sturgeon are used in making caviar. They are not taken when the female is ready to spawn, but at an earlier period, when the roe is still "hard." The quantity taken varies, of course, with the size and quality of the female, ranging from 5 to 15 gallons in bulk and from 800,000 to 2,400,000 in number.

In the making of caviar the eggs are removed from the fish and gently rubbed over a fine screen, by which they are separated from their enveloping membrane. Under the screen the released eggs fall into a trough, through which they pass into tubs. In these tubs salt is carefully stirred with the eggs, and it draws their watery constituents from them and forms a copious brine. Later the eggs are poured into fine-meshed sieves, where they are allowed to drain until dry. They are then put into casks or cans and are ready to go into commerce.

Overfishing has done vast harm to the Sturgeon supply. In the early decades of American history it was not much in favor, though New Yorkers ate some of it as "Albany beef"; but in later decades it became a popular market fish, and along Delaware Bay were hundreds of fishermen who earned their living catching Sturgeon and making caviar. Women and children spent their long winter evenings making Sturgeon nets. In all the bay-side towns there were Sturgeon boats awaiting the coming of the fish.

In those days the Sturgeons were plentiful, and caviar sold for from $9 to $12 a cask, which contained 135 pounds, and the output ran up into the thousands of casks. But overfishing and heedlessness of consequences sealed the doom of the fishery. Caviar went up to $120 a cask, even as far back as 1902, and although hundreds of fishermen fished every day for eight weeks, the best their combined efforts could produce was 68 casks. To-day Sturgeons are rare prizes, worth several hundred dollars each.

SQUIRREL HAKE (Urophycis chuss)

(For illustration see Color Plate V)

The Squirrel Hake and its close relative, the White Hake, *Urophycis tenuis*, belong to the Codfish family and are found on the Atlantic coast from Labrador to Hatteras. They are both ground fishes, staying close to the bottom. They are said to bite best on moonlight nights. The Hake fisheries rank about sixth in the number of tons taken in New England waters annually. They are used extensively in making boneless Cod and for corning. Their air bladders find wide use in the manufacture of isinglass and glue.

The Squirrel and White Hakes resemble each other so closely that even to the trained eye of the zoölogist the difference is not marked. The most tangible distinction is in the number and size of the scales. These are smaller, and therefore more numerous, in the White Hake. In the latter there are about 135 or 140 oblique rows of scales from the branchial opening to the caudal fin, as compared with about 100 in the Squirrel Hake.

These Hakes are not to be confused with another group of fishes sometimes called Hakes, but more commonly known as the Whitings. The representative species of the latter group is *Merluccius bilinearis*, sometimes called the Silver Hake.

CUSK (Brosmius brosme)

(For illustration see Color Plate V)

The Cusk is a member of the Codfish family, inhabiting rocky ledges in deep water in the North Atlantic above Cape Cod. It reaches the coast of Greenland and swings around the North Atlantic basin to Iceland, Norway, and Denmark.

This fish disappears from a given haunt after prolonged fishing and moves on to some other ledge. After a lapse of years it may return to the deserted ledge again.

The food of the Cusk consists of Mollusks and small crustaceans. It is an excellent food fish and is widely caught in the present New England fisheries.

WHITING (Merluccius bilinearis)

(For illustration see Color Plate V)

Sometimes known as the Silver Hake, this species is now coming to preëmpt the common name Whiting—a term which in former days was applied in divers localities to various species of fishes belonging to as many different families.

It commonly inhabits the middle depths of the ocean or the outer edge of the continental slope, but finds its feeding ground at or near the surface, where it preys upon schools of Herring and other small fish. Usually, when attacking its victims, it congregates in schools of considerable numbers. Its teeth are sharp, and it possesses a large and powerful mouth and a form muscular and lithe, which adapts it to rapid locomotion; for it, like the Pollock, is essentially a fish of prey. Its average length is about a foot.

Prior to 1880 the breeding habits of the Whiting were a mystery. An exploration of the sea bottom off Newport, at a depth of from 150 to 300 fathoms, revealed immense numbers of young fish from one-half an inch to three

Photograph from H. L. Rust, Jr.

A "GIANT" LOBSTER THAT LOST ITS LUCK

Big fellows like the one here shown are probably not giants of their species, but merely those to whom fate was so kind as to allow them to grow to their full maturity. It may have escaped the perils of half a century before the luckless hour when it became enmeshed in some fisherman's gear (see text, page 581).

inches long, and with them were many adults from one foot to one and a half feet long, apparently in the midst of the spawning season.

The New England Whiting is closely related to the European Hake, *Merluccius merluccius*, and to the California Hake, *Merluccius productus*. It appears that the spawning time of the European Hake is from January to April. During this period both species seem to lose the great voracity which characterizes them at other times, and are mostly taken at that season in trawls rather than with lines.

MACKEREL (Scomber scombrus)

(For illustration see Color Plate VI)

The Mackerel is a member of the Mackerel family, which includes the Tuna, the Bonito, the Kingfish, and the Wahoo, or Peto. It ranges as far south as Hatteras and as far north as the Straits of Belle Isle, and, being a shore-loving fish, does not wander far to sea. It first appears on the Hatteras coast in the early spring, and gradually migrates north, its migration seeming to be regulated by the fluctuation of water temperature. Schools 20 miles long and half a mile wide have been sighted. In the seventies an international dispute arose regarding the migration of these fishes. Our Government took the position that the Mackerel do not come from deep water offshore to warmer water inshore, but that they are first found in the spring off Cape Henry and can be followed day by day as they move, in countless hordes, northward to Maine and Nova Scotia. Canada held that they came inshore from deep water offshore. The American viewpoint has been proven correct.

The spawning season for the Mackerel extends from May to July. The spawning grounds are in rather deep water off the coast, stretching between Long Island Sound and the Gulf of St. Lawrence. Prior to spawning the fish are lean and their flesh is of poor texture, but after that task is over they get fine and fat, being regarded as among the best fishes in Atlantic waters.

The food of the Mackerel consists of small crustaceans, Lobster spawn, and the "small fry of the seas." One tiny crustacean favorite is the red, spiderlike creature known as "the Boone Island bedbug," and old fishermen declare that wherever it is found they can afford to wait, for it is bound to bring the Mackerel to its feeding ground.

Many enemies prey on the Mackerel. The gannets often eat so many that they are unable to rise from the sea to avoid a passing ship until they have disgorged several good-sized fish. Porpoises, whales, Sharks, and Dogfish also are dangerous enemies. Indeed, the last named are sometimes so hungry that they will bite the twine of the fishermen's nets to get inside and prey upon the catch at will. They

Photograph by Underwood & Underwood

A RED SNAPPER EXHIBITED ON "NATIONAL FISH DAY" AT FULTON MARKET, NEW YORK

Many market fishermen, who supply the demands of northern cities from waters offshore during the summer, move southward from New England to Miami Beach, Florida, during the winter season in order that their customers may have an uninterrupted supply of Kingfish, Mackerel, Snappers, and the varieties of fish highly prized for the family table.

have also been known to follow the catch to the very sides of the ships and swim around the scuppers and drink the blood flowing from the dressing operations aboard the boat.

The Squids also are enemies. They suddenly dart back among the Mackerel with arrowlike speed, and, quickly turning to one side, seize a victim, sink their sharp beaks into the nape of the neck, and kill it almost instantly by severing the spinal cord. Sometimes they fail. When they do, they drop to the bottom and change their color from translucent paleness to that of sand, in order to camouflage their presence while waiting for the Mackerel to return. The latter usually stay well inshore, and are warned of the enemy's presence, for as soon as the Squid gets into too shallow water it begins to pump with great energy and to discharge its ink in large quantities. Thousands of them are stranded and perish when their eagerness for a dinner leads them into shallow water.

TUNA (Thunnus thynnus)

(For illustration see Color Plate VII)

Few fishes have a wider distribution than the Tuna, for it is found in all warm seas. It is pelagic in its habits and occurs as far north as Newfoundland. It is the Tuna of California and the Mediterranean, the Tunny of the British Isles, the great Albacore, or Horse Mackerel, of our Atlantic waters. It belongs to the Mackerel family, of which it is the largest representative. On the North Atlantic coast, where Tuna are caught from early summer to October, they are large and numerous. During one season a single fisherman harpooned 30 of them with an average weight of 1,000 pounds. Some weighing 1,500 pounds have been taken. They also are caught on hooks baited with Herring attached to heavy lines.

The European varieties do not attain such size, 500 pounds being considered about the upper limit of their weight. On our California coast they are still smaller.

It is on this coast that they are considered the game fish *par excellence.* Charles F. Holder once observed that, weight for weight, the Tuna has double the fighting power in it that the Tarpon possesses. He called it the tiger of the California coast, a living meteor that strikes like a whirlwind and plays like a storm.

In American Atlantic waters the Tuna is found from Nova Scotia to Cape Cod. It feeds on Herring, Menhaden, and Bluefish.

SHAD (Alosa sapidissima)

(For illustration see Color Plate VIII)

The Shad belongs to the Herring family and is an anadromous fish, spending the spring

months in the rivers, where it spawns, and the rest of the year in deep-sea waters. On the Atlantic coast it enters all rivers between the St. Johns in Florida and the St. John in New Brunswick. Thanks to the good work in artificial propagation of the United States Bureau of Fisheries, Gulf of Mexico and Pacific coast rivers also know this delectable food fish to-day.

Formerly Shad were surprisingly abundant; but they have to be taken at spawning time, since they are not within reach of human hands at any other season; therefore they are especially liable to extinction by overfishing. Were it not for protective laws and artificial propagation, they would probably have disappeared almost entirely before now. The success of artificial propagation is shown by the fact that the Shad has been established along 2,000 miles of shore line on the Pacific where it never existed before, and that it remains, in spite of the heavy toll of overfishing, next to the Chinook Salmon, the most important river fish in America. But even with artificial propagation the catch has been diminishing at an alarming rate, having fallen off from 50,000,000 pounds in 1898 to less than one-half as much in a recent year. Overfishing, the placing of dams across many rivers, and water pollution have been responsible for the decrease.

The Shad does not appear to be a migrant from warmer to cooler waters with the advent of spring, as was formerly supposed. Rather, it seems to go out to the deep sea off the mouths of the several rivers it spawns in, and to remain there until the temperature of the river waters rises to about 60 degrees. The Shad in southern rivers has black-tipped back and tail fins, which is a mark absent in those visiting northern rivers.

The young fry, hatched out in the rivers, stay until the water falls below 60 degrees in the autumn, and then go out to sea and are not seen again until they enter the rivers to spawn, which is believed to be when they are three or four years old. The spawning Shad like to find water above 60 degrees, and go up the rivers, but the half-grown ones, preferring cooler water, stay behind. In 1882 there was a very late spring, the water not reaching 60 degrees until after spawning time. It was noted that the half-grown accompanied their elders to the spawning grounds that year.

During the spawning season the mature Shads seem to take no food at all. Their young, after hatching, feed on small crustaceans and insect larvæ until they go out to sea. The fact that the adults will rise to a skillfully placed fly at times indicates that their abstinence is due more to their impulse to hasten to spawn than to their lack of desire for food. They are a very prolific fish, yielding as high as 150,000 eggs a season. The roe of no fish is more delicious than that of the Shad, and a planked Shad garnished with roe and bacon is as much a delight in the Nation's Capital in 1923 as it was in the days of Mt. Vernon and Marshall Hall, when the Father of his Country and the Laird of Marshall Hall were friends.

The Shad sometimes attains a length of more than 2 feet and a weight of 14 pounds, but the average weight has been falling as the decades have come and gone, until now it is probably under 4 pounds.

ALEWIFE (Pomolobus pseudoharengus)

(*For illustration see Color Plate IX*)

The Alewife is a species of Herring abundant in North Atlantic waters, possessing many vernacular names. In some places it is known as the Branch Herring, in other localities as the Blear-eyed Herring, and elsewhere as the Wall-eyed Herring and the Gaspereau. It is found on our Atlantic coast from the Carolinas northward, in Lake Ontario, and in some of the small New York lakes tributary to the St. Lawrence. Like the Shad, it goes up into the rivers to spawn, preceding that fish by two to three weeks.

Those Alewives that have become landlocked in fresh water are greatly dwarfed in size. In Lake Ontario many millions die every summer.

Another species, so closely related that for a long time it was not differentiated from the Branch Herring, is *Pomolobus æstivalis*, known in New England as the Summer Herring and in other localities by such names as Glut Herring, School Herring, Blueback, May Herring, Kyack, and Blackbelly.

It is found from St. Johns River, Florida, along the entire Atlantic coast of the United States and the British Maritime provinces. The great centers of abundance are Albemarle Sound and Chesapeake Bay, where it is known as the Glut Herring, this term having reference to its abundance, which frequently leads to a glutted market.

The circumstances under which the two species were differentiated form a tribute to the keen-eyedness of Potomac fishermen. The attention of the zoölogists of what was then the Fish Commission was first called to the probable existence of the two species by the persistent opinions of the fishermen of the Potomac, who recognized two forms, differing somewhat both in habits and in appearance. These two forms they called respectively the Branch Herring and the Glut Herring.

The first announcement of the discovery of the existence of two species and the definition of their respective characteristics was published in a report of the Virginia Fish Commission for 1879. Goode remarks that, although the coast fishermen of Massachusetts and Maine claim to distinguish between the Alewives and the Bluebacks, their judgment is by no means infallible, since, when he had finished sorting them out into two piles, the fishes which they distinguished under these names were not at all accurately classified.

Like the Shad, both the Branch Herring and the Glut Herring are anadromous in habits.

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POLLOCK (*Pollachius virens*) [at top]; CODFISH (*Gadus callarias*) [center]; HADDOCK (*Melanogrammus aeglifinus*)

Ranging across the Atlantic and as far south as Cape Henry, the Pollock, also known as Green Cod, or Coalfish, attains a weight of 35 pounds and a length of four feet. The liver yields an oil not inferior medicinally to that of the Cod. The temperature of many parts of the North Atlantic is so low that Codfish may be caught the year round. The catch of Haddock in recent years has made it a rival of the Cod, which it now occasionally outranks.

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WINTER FLOUNDER (*Pseudopleuronectes americanus*) [upper left]; SUMMER FLOUNDER (*Paralichthys dentatus*) [center]

The Winter Flounder belongs to the Plaice tribe and, next to the Halibut, is the most widely caught Flatfish in Atlantic waters. It ranges from Labrador to Hatteras, being especially abundant on the shores of Massachusetts and Connecticut. The Summer Flounder, like the Winter species, habitually lives at the bottom, where its shape, color, and sand-burrowing habits effectively camouflage it. Note the one nearly buried in the sand. The migration of the Flounder's eyes is a strange phenomenon of fish life (described in text).

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HALIBUT (*Hippoglossus hippoglossus*)

The Halibut is the largest fish of the Flounder family, claiming all seas in regions north of 41 degrees for its habitat. Species inhabiting cold water have eyes and color on the right side. The Halibut is found mostly in deep gullies between offshore banks and on the outer edges of those banks in water 100 to 350 fathoms deep. Like the Flounder, the Halibut buries itself in the sand to hide from its enemies and to catch its prey.

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COMMON STURGEON (*Acipenser sturio*)

Common Sturgeons are found from the Carolina coast to the Maine Gulf, with the Delaware River the region of their greatest abundance. Once they were plentiful, but over-fishing has so reduced the supply that the taking of one is decidedly rare, and when taken living it sells for several hundred dollars. The spawning season is regulated somewhat by the temperature of the water, May being the usual month in the Delaware River. The eggs are used in making caviar.

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SQUIRREL HAKE (*Urophycis chuss*) [at top]; CUSK (*Brosmius brosme*) [center]; WHITING (*Merluccius bilinearis*)

The Squirrel Hake, belonging to the Codfish family, ranges from Labrador to Hatteras on the Atlantic coast. It is used in making boneless Cod, and its air bladder is used in the manufacture of isinglass and glue. The Cusk, also a member of the Codfish family, is widely caught in the present New England fisheries. The Whiting, sometimes known as the Silver Hake, commonly inhabits the middle depths of the continental slope.

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MACKEREL (*Scomber scombrus*)

The Mackerel is a member of the family which includes the Bonito, Tuna, Kingfish, and the Wahoo or Peto. It ranges between Hatteras and the Straits of Belle Isle, appearing on the Hatteras coast in early spring, and gradually migrating north. The spawning season extends from May to July, the grounds being in rather deep water off the coast between Long Island Sound and the Gulf of St. Lawrence. The Mackerel has many enemies, among which are the Gannets, Porpoises, Whales, Sharks, Squids, and Dogfish.

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TUNA (*Thunnus thynnus*)

The Tuna belongs to the Mackerel family, of which it is the largest representative, and has a wider distribution than most fishes. It is found in all warm seas, and occurs as far north as Newfoundland. On the North Atlantic coast it is caught from early summer to October. During one season a single fisherman harpooned thirty Tuna of an average weight of 1,000 pounds, although some weighing up to 1,500 pounds have been taken.

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SHAD (*Alosa sapidissima*)

Belonging to the Herring family, the Shad spends its spawning season in the rivers and the rest of its life in deep sea waters. Because it is not within reach of fishermen except at the spawning season it is especially liable to extinction by over-fishing, and were it not artificially propagated it now would rarely appear on the American dinner table. Through the work of the United States Bureau of Fisheries it has been established along some 2,000 miles of Pacific Coast shore line, from the Atlantic seaboard, where it is indigenous.

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ALEWIFE (*Pomolobus pseudoharengus*) [at top]; HERRING (*Clupea harengus*)

The Alewife, variously known as the Branch Herring, the Blear-eyed Herring, the Wall-eyed Herring, and the Gaspereau, is found on our Atlantic coast from the Carolinas northward. The Herring family includes the Sardines, Alewives, Shad, and Menhaden. *Clupea harengus* is probably the most important food fish in the world, and is distributed throughout the North Atlantic Ocean Unlike most fishes, the Herring is particularly fine-flavored at spawning time.

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Painted by Hashime Murayama

TAUTOG (*Tautoga onitis*)

The Tautog, a stockily built member of the Wrasse family, ranging from New Brunswick to the Carolinas, is variously known as the Tautog or the Blackfish. Its food consists mainly of hard-shelled Mollusks, Squids, Scallops, Crabs, Barnacles, and Sand Darters. It eats shell and all, and regurgitates the indigestible parts. The Tautog's scales and mouth are hard, and it possesses an eel-like slipperiness.

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BUTTER-FISH (*Poronotus triacanthus*) [at top]; SCUP (*Stenotomus chrysops*)

Known as the Dollar-fish in Maine, the Butter-fish in Massachusetts and Norfolk, and the Pumpkin Seed in Connecticut, *Poronotus triacanthus* arrives and departs with the Mackerel. It has the habit of accompanying, in small groups, the Sun-squall Jellyfishes, but whether for the shelter of the Sun-squall's disks, or for the diet of soft-bodied invertebrates entangled in the latter's tentacles, is not known. The Scup of New England is the Porgy of New York, and the

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ATLANTIC SALMON (*Salmo salar*)

At least half of the Salmon's life is spent in the ocean, the other half in fresh water, where it spawns. Although temperature changes do not influence its movements as much as those of other species, the eggs are not deposited before the water has fallen to 50° F. It seems to enter the rivers on a rising temperature, and may be found in the Connecticut in April and May, in the Merrimac in May and June, and in the Penobscot in June and July.

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SWORDFISH (*Xiphias gladius*)

Sometimes reaching a weight of 800 pounds, the Swordfish rivals the Shark in size and strength. Its distribution is wide; it is the *Zwaard-fis* of the Dutch, the *Soña* of the Italians, the *Espada* of the Spaniards, and the *Épée de Mer* of the French. The Swordfish is a worthy antagonist, and it is recalled that many a small vessel has limped into port leaking badly as a result of attacks by wounded Swordfish.

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SMELT (*Osmerus mordax*)

With a range from the Virginia Capes to the St. Lawrence Gulf, *Osmerus mordax* is the leading American Smelt. Large quantities of Smelts are taken during the winter, most of which are frozen and shipped to the larger cities. Those shipped in their natural state are termed Green Smelts and are rated very high for table use. This fish is structurally similar to the Salmon, except in size. The stomach of the former is a blind sac with two openings close together, while that of the Salmon is siphon-shaped.

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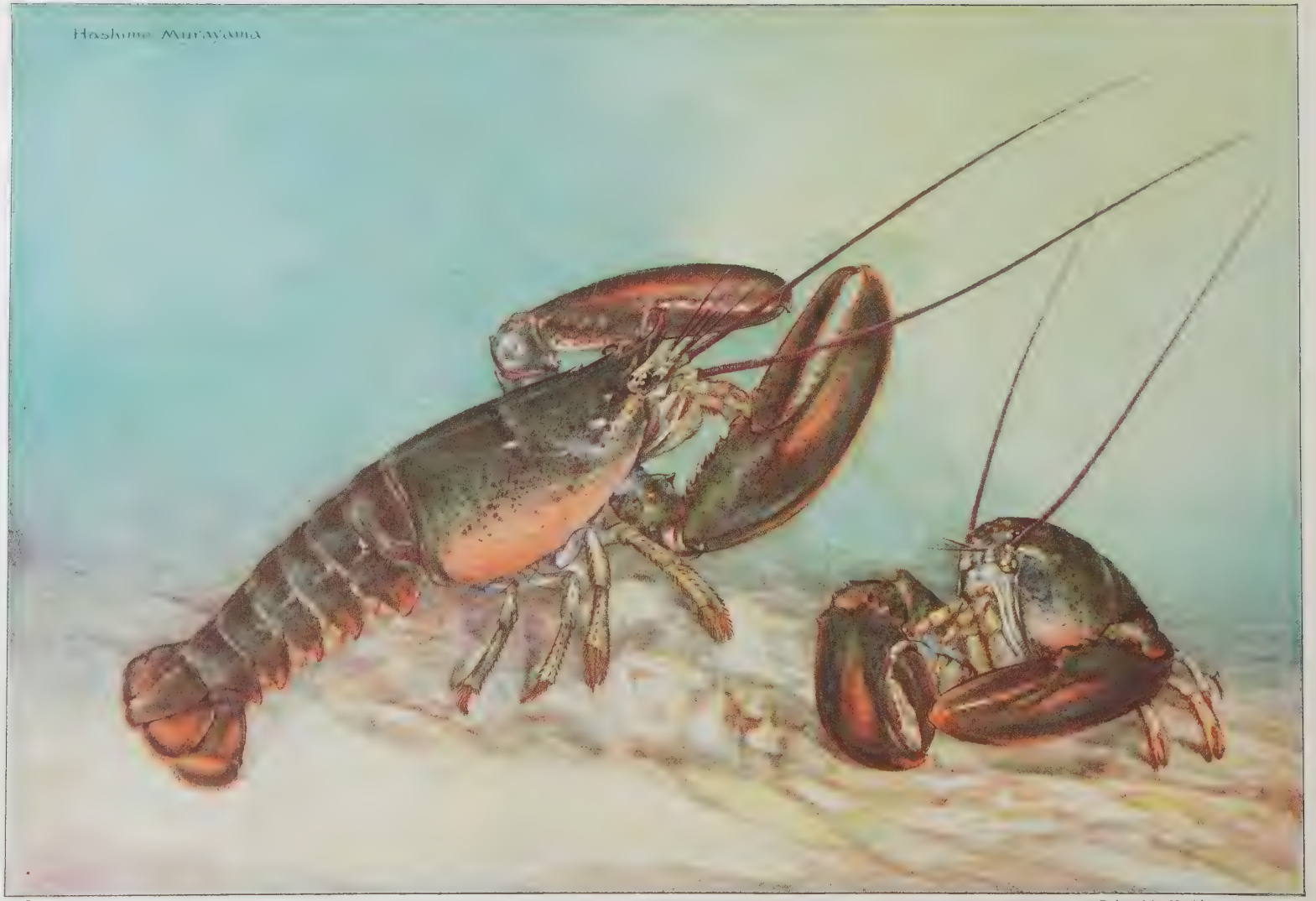
TILEFISH (*Lopholatilus chamaeleonticeps*)

In 1879 a New England trawler, fishing for Cod off the Nantucket coast, took five thousand pounds of Tilefish—the first of which there is any record. A few years later literally millions of Tilefish were found dead, floating on the waters of the North Atlantic. The solution of the mystery of their destruction and the prediction of their return constitute a notable chapter in the history of marine biology.



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AMERICAN LOBSTER (*Homarus americanus*)

With the supply constantly growing scarcer, and prices ever rising, the Lobster fisheries of New England appear to be doomed unless new legislation, framed in the light of the results of the biological investigations of the United States Bureau of Fisheries, is enacted promptly. The steps recommended include the licensing of every Lobster fisherman and the adoption of a standard trap or pot which shall permit the escape of all Lobsters under nine

The dates of their first appearance in any given river closely agree with the movements of the Shad. The Branch Herring usually precedes the Shad by a fortnight or so and the Glut Herring comes about the middle of the Shad season.

Little is known of the food of the river Alewives and of their salt-water habitat, although it is believed that they, like the Shad, feed largely on living crustaceans. In the rivers they seem to eat very little.

They spawn after entering fresh water—the Branch Herring when the temperature has reached 55 to 60 degrees Fahrenheit and the Glut Herring when it attains 70 to 75 degrees.

The late Professor Baird regretted the absence of effort to restore the Alewife to its primitive abundance, and declared in one of his reports to Congress that the Alewife is in many respects superior in commercial and economic value to the Herring. He noted that it is a much larger and sweeter fish than the Herring, being more like the Shad. He attributed the diminution of the Alewife supply to the erection of dams and other barriers, and expressed the belief that the gradual wearing down of the Cod, Haddock, and Hake fisheries along the American coast is due more to the diminution of the Alewife supply than to any falling off in the number of sea Herring as food for these fishes.

HERRING (Clupea harengus)

(*For illustration see Color Plate IX*)

The Herring family includes not only the Herrings, but also the Sardines, the Alewives, the Shads, and the Menhadens.

Distributed throughout the entire North Atlantic Ocean, the Herring, *Clupea harengus,* is probably the most important food fish in the world.

With so many other species in competition, the Herring has never attained the popularity on the American dinner table that it has on those of Europe, where it forms a staple diet for millions; but even in our waters it is widely taken north of Cape Cod. Most of the fish are sold fresh, either for human food or Cod bait. Immense quantities of the young ones are packed and sold as Sardines.

Years ago Professor Huxley estimated that three billion Herring were being caught annually. With the growth of the fishing industry in European waters, it has been estimated that the annual catch now exceeds ten billion. A single shoal sometimes covers six square miles and is estimated to contain at least half as many Herring as the whole world catches in a year. Many such shoals are known to exist.

The Herring, unlike most fishes, is particularly fine-flavored at spawning time, and the fisheries are carried on busily during that season. Usually the Herring is taken with gill nets anchored below the surface of the waters, in which so many are sometimes enmeshed as to sink the buoys. Other forms of taking it are by means of weirs and torching. The latter is particularly resorted to when cold weather sets in. A torch is set in the bow of the boat. The fish rise to the surface as the vessel glides swiftly along, and are scooped in without difficulty.

The food of the Herring consists principally of "red feed" and Shrimp. They are in turn preyed on by a list of enemies as long as the moral law, ranging from finback whales, porpoises, and seals to Cod, Dogfish, and Squids.

When schools of enemy fish attack the Herring the sea gulls are always on the job to gather up the scraps of the fray.

The life history of the Herring has never been completely worked out. The facts known indicate that it lives in deep water off the coasts, coming inshore to spawn. There seems to be a number of distinct races, differing as to size, spawning time, and various other qualities and traits, each race swimming in a separate school and having its own particular time and ground for spawning. The number of eggs laid by a female ranges from 10,000 to 50,000, it is said.

TAUTOG (Tautoga onitis)

(*For illustration see Color Plate X*)

The Tautog is a species of the Wrasse family, stockily built, with a range from New Brunswick to the Carolinas. North of New York it is called the Tautog, while New York knows it as the Blackfish. Farther south it is called the Oyster Fish. The average weight is about three pounds, though occasionally one is taken weighing as much as 22 pounds. It has hard scales, a hard mouth, and a slipperiness that is eel-like.

The Tautog's food consists mainly of hard-shelled Mollusks, Squids, Scallops, Crabs, Barnacles, and Sand Darters. It eats them, shells and all, and then regurgitates the undigestible parts.

Close relatives of *Tautoga onitis* are El Capitan, or the Hogfish, of Florida waters and the Fatheads or Redfishes of the southern California coast.

All of the Tautogs belong to the Wrasse family, *Labridæ,* which is one of the largest known, including some 450 species, divided into about 60 genera.

BUTTER-FISH (Poronotus triacanthus)

(*For illustration see Color Plate XI*)

The Butter-fishes form a large group of small fishes, many famous for the fine quality of their flesh. *Poronotus triacanthus* is known as the Dollarfish in Maine, the Butter-fish in Massachusetts and Norfolk, the Pumpkin Seed in Connecticut. It is a summer visitor, appearing and disappearing with the Mackerel. It has the habit of accompanying, in groups of ten or twelve, the Sun-squall Jellyfishes in the inshore waters of the middle Atlantic, seeming to seek shelter from its enemies under the Sun-squall's disks, or possibly finding there

SWORDFISH TAKEN IN CAPE BRETON WATERS

It has long been the opinion of ichthyologists that the Swordfish's spawning ground is in the Mediterranean Sea. The fact that small ones are constantly caught in the Mediterranean, but that only larger ones are taken in American waters, seemed to justify the conclusion that they did not spawn on this side of the Atlantic. But recently a small Swordfish weighing less than eight pounds was taken near Boston and a female containing spawn was landed at New Bedford. This evidence has served to reopen the question.

a diet of the soft-bodied invertebrates that are constantly becoming entangled in the tentacles of the Jellyfish. But its position is not always a safe one, since it sometimes is lassoed in these same tentacles and eaten by its host.

The Harvest Fish (*Peprilus paru*), which ranges from Cape Cod to Brazil, but is especially abundant off the Virginia capes, is another member of the Butter-fish family. It reaches a length of 10 inches, and has the peculiar habit of swimming under the Portuguese Man-of-War, probably gathering the scraps that fall from the table of that fish, as well as enjoying protection from its enemies.

The Poppy Fish (*Palometa simillima*) found on the sandy shores of California is a close duplicate of the Dollarfish, and the San Francisco epicure pays a high price for it, supposing it to be Pompano, though admitting that the Pompano of the Florida coast has a finer flesh and better flavor.

SCUP (Stenotomus chrysops)

(*For illustration see Color Plate XI*)

The Scup belongs to the Porgy family, which also includes the Porgies and the Sheepsheads. The Scup (*Stenotomus chrysops*) ranges between Cape Cod and the Carolinas. It is the Scup in New England, the Porgy in New York, and the Fair Maid farther south, getting back to the Porgy again at Charleston. New Englanders often call it the Scuppaug, a corruption of the Narraganset Indian name, Muscuppanog. As a food fish it is one of the commonest and is highly esteemed for its flavor. A bottom-feeder, the Scup's diet is largely made up of Mollusks, small crustaceans, and worms. Along the South Atlantic coast the Scup is replaced by a closely related species *Stenotomus aculeatus*.

ATLANTIC SALMON (Salmo salar)

(*For illustration see Color Plate XII*)

Eighteen hundred years ago Pliny wrote that the Salmon surpassed all the fishes of the sea in the river Aquitania. That is the earliest allusion to *Salmo salar* known in literature, and although scores of other species have been identified, still *Salmo salar* is *the* Salmon outside of the canneries of the Pacific, which utilize other species.

The species inhabits both sides of the Atlantic and ascends the rivers as far as it can go in the spawning time, going up the St. Lawrence and through Lake Ontario to Niagara Falls.

At least half the Salmon's life is spent in the ocean, recalling Izaak Walton's remark that "he is ever bred in fresh rivers and never grows big but in the sea. . . . He has, like some other persons of honor and riches which have both their winter and summer houses, the fresh water for summer and the salt water for winter to spend his life in."

The Connecticut River once teemed with Salmon, but dams exterminated the species therein. The same fate has befallen them in many other rivers.

The young fish stay in fresh water for one or two years, and then wander out to sea, although they weigh only a few ounces when they go. There they find congenial food and grow rapidly. In that pleasant environment they remain until summoned, as Dr. Goode says, by the duties of family life to return to the narrow limits of the old home. When they live in the lakes they prey on Minnows and other small fishes, but those of the sea delight also in small crustaceans and crustaccan eggs, to which they are said to owe the vivid color of their flesh. The habits of successive generations become hereditary traits and the differences in their life histories are held by many authorities to justify the belief that the landlocked Salmon is merely a variety of *Salmo salar*.

Although the Salmon, like the Trout, spawn with a falling temperature, not depositing their eggs before the water has dropped to 50 degrees, they seem to enter the rivers on a rising temperature. In the Connecticut they appear in April and May, in the Merrimac in May and June, and in the Penobscot in June and July.

Temperature changes do not influence the movements of the Salmon as much as those of other species. It is said that two-thirds of the colony belonging to a particular river may be found in it in any season. This high proportion is made up of half the colony, less than a year old, and the breeding fish, which remain in the rivers six or seven months after the spawning season.

When they leave the ocean, they first enter the brackish water at river mouths, where they remain for several weeks; then they start for the spawning grounds, which they usually reach in late summer. At the approach of the spawning season their trim shapes and bright colors disappear, leaving them lank and misshapen, with fins thick and fleshy and skin slimy and blotched. This transformation takes place especially in the males. The jaws become so curved that they touch only at the tip, the lower of which develops into a large and powerful hook, used as a weapon in the savage combats which they stage with their rivals.

When the newly hatched Salmon appear they are about three-fourths of an inch long and the yolk sac is visible on them for from four to six weeks. When this is absorbed the youngling begins to feed, readily seizing any minute floating object. In two months it has grown to one and one-half inches and begins to assume the vermilion spots and transverse bars which it retains until it begins its descent to the sea, when it adopts a uniform bright silvery coat. After remaining in the sea for a period of from 4 to 28 months, it heads back to land, and then dawns the time that every fisherman loves, for at this stage nothing in the water surpasses it in symmetrical beauty, brilliancy, agility, and pluck. Christopher North has called it "a salmon fresh run in love and glory from the sea. . . . She has literally no head; but her snout is in her shoulders. That is the beauty of a fish, high and round shoulders, short waisted, no loins, but all body and not

long of terminating—the shorter still the better—in a tail sharp and pointed as Diana's, when she is crescent in the sky."

SWORDFISH (Xiphias gladius)

(For illustration see Color Plate VIII)

The Swordfish ranges in Atlantic waters from Cuba to Cape Breton. The extent of its range is attested by the fact that the Dutch call it the *Zwaard-fis;* the Italians, *Sofia;* the Spaniards, *Espada;* and the French, *Épée de Mer.* Aristotle named it Xiphius some twenty-three centuries ago. It rivals the Sharks both in size and strength, sometimes reaching a weight of 800 pounds, although most of those caught weigh less than half as much. It usually appears on the shoals and banks in June and stays until the colder fall months set in. It is believed to come out of the deeper waters in search of food, since its spawning grounds are not in shallow regions. It apparently follows the Menhaden and Mackerel. Old fishermen have a saying that where you find Mackerel you may expect Swordfish. When swimming near the surface, it usually comes so close to the top that the tips of its back and tail fins are exposed.

This exposure enables the fisherman to detect its presence, and, being given to swimming slowly at times, it is easily overtaken by a schooner with a light breeze to drive it. Every now and then it leaps entirely out of the water, and old fishermen attribute this to tormenting parasites; but modern authorities disagree with that theory. Be that as it may, one authority tells us that it strikes with the force of fifteen double-handled hammers and with the velocity of a swivel shot.

Its stupidity in attacking ships and other objects sailing the seas is so great that Oppian tells us that "Nature her bounty to his mouth confined, gave him a sword, but left unarmed his mind."

The feeding habits of the Swordfish are striking. It is said that it swims under a school of small fishes, and then, suddenly rising to the top, thrashes about with its sword, killing a number of its prey in the act. These it promptly devours and then repeats the performance.

It is said the Swordfish never comes to the surface except in moderate, smooth weather. Once it is sighted the lookout at the masthead "sings out," and the skipper takes his place in the "pulpit," on the end of the bowsprit, holding the harpoon pole in both hands by the small end. Directing the helmsman, he guides the vessel toward the quarry, and when the fish is eight or ten feet off the prow, rams the harpoon into its back. The fish is allowed plenty of line, and then two men go out in a yawl and maneuver the victim alongside, where it is killed with a whale lance.

There are some of the thrills of whaling in swordfishing, since there is no slow baiting or careful waiting and no bother with nondescript bait-stealers. The Swordfish is a worthy antagonist, and many a vessel has limped into port, leaking badly as a result of attacks by wounded Swordfish. Occasionally a small boat is attacked and the sword rammed clear through its side. Once the sword punctured two inches into the heel of a sailor standing in the boat.

SMELT (Osmerus mordax)

(For illustration see Color Plate XIV)

The Smelts are structurally akin to the Salmons, being largely like them except in size. The other chief difference is in the form of the stomach, which, in the Smelts, is a blind sac, with the two openings close together, while in the Salmons it is siphon-shaped. All of the species are small and most of them stick strictly to the sea, although a few go up rivers to spawn, after the fashion of the Salmons. All of the abundant species are edible, the flesh being extremely delicate and often full of a fragrant, digestion-aiding oil.

The leading American Smelt is *Osmerus mordax,* a shapely little creature that is rarely longer than 10 inches. It ranges along the coast from the Virginia Capes to the St. Lawrence Gulf, and enters the streams and brackish bays to spawn during the winter months, when it is taken in great numbers, with hook and line and in nets.

In going up streams some of the Smelts have lost their way and become landlocked in numerous lakes such as Champlain and Memphremagog.

The fishermen take vast quantities of them during the winter, most of which are frozen and sent to the larger cities. Those that are not frozen are termed Green Smelts and are rated very high on the scale of finely flavored fish. Shrimps and other small crustaceans form the favorite food of this species.

Captain John Smith, of Jamestown fame, wrote in 1622 that there was such an abundance of them that the Indians dipped them up from the rivers with baskets used like sieves.

Another Smelt that belongs in the fine-food category is the Capelin, found from Cape Cod to the Arctic on the Atlantic coast and in Alaskan waters on the Pacific. Its eggs are deposited in vast quantities in the sands along the shore. These, washed up on the beaches, present the appearance of masses of little fishes, eggs, and sand. Hatching takes place in about thirty days, and the youngsters ride the first waves out into the sea.

Still another Smelt that meets with favor wherever it abounds is known as the Eulachon, or Candlefish (*Thaleichthys pacificus*), which lives in great numbers on the Pacific coast from Oregon northward. It is said to be unsurpassed in delicacy of flavor, which is described as exceeding that of any Trout. It is remarkable for its extreme oiliness, which is so great that, when dried and a wick put into its body, it serves as a candle; hence its name. The oil is sometimes extracted and used as a substitute for cod-liver oil. At ordinary temperatures it is solid and lardlike in its consistency.

TILEFISH (Lopholatilus chamaeleonticeps)

(For illustration see Color Plate XV)

There is no greater wonder story of the seas than the history of the Tilefish. To-day some connoisseurs pronounce it second only to the Pompano in flavor, and it is receiving much attention from those who are not Bourbons in matters of food.

Prior to 1879 this fine fish had no place in the roster of known fishes. In that year a New England trawler, fishing for Cod off the Nantucket coast, took 5,000 pounds of Tilefish, the first of which there is any record. Whether eaten fresh, salted, or smoked, the samples the trawler took home proved attractive.

For three years there was widespread interest in this newly found food fish. Then, in April and May, steamers arriving from Europe reported seeing myriads of dead Tilefish. One steamer reported that it had sailed through 150 miles of them, and data gathered indicated that perhaps 7,000 square miles of sea surface was strewn with the victims of some untoward circumstance of the sea. It was estimated that the total number of dead fish might reach a billion and a half.

There were no signs of disease and no evidences of parasitic infection. Neither could the calamity be accounted for on the basis of attack by other creatures.

All sorts of theories were advanced to explain the catastrophe—submarine volcanoes and poisonous gases among them.

It had been noted, however, that there was a strip of water, lying on the border of the Gulf Stream slope, between the Arctic current and the cold depths of the sea, which was warmer in 1879 and 1880 than the normal water of that region. Dredging in this water had revealed many species of marine invertebrates characteristic of the waters of the lower latitude, a sort of tropical faunal peninsula in the sea.

In 1882, after the vast schools of Tilefish had disappeared, this region was resurveyed. It was found that the water was colder, and that the marine life that formerly occupied this thermal peninsula had disappeared. What had happened was that northern gales had driven Arctic ice down into the area and had made the water too cold for the Tilefish to bear.

It was predicted that if this were the correct explanation, and if the water came back to its usual temperature again, the Tilefish would ultimately reappear. But years went by and not a single survivor of the catastrophe was found. Fears began to be entertained that the species had been wholly exterminated by the calamity that had befallen it.

But in 1892 the *Grampus* caught eight. Increasing catches with successive years showed that the Tilefish was gradually reëstablishing itself, just as the scientists had predicted it would.

But after the Tilefish appeared again the task arose of introducing it to the dining table of the American people. Possessed of a flesh of fine texture and good flavor, the difficulty lay only in the inertia of the people against trying new kinds of food. The Bureau of Fisheries, however, undertook propaganda in favor of the Tilefish and met with fair success. For awhile it was the most advertised fish in American waters. At present it has to rely on its own flavor to carry it to a wider and disinclined-to-try-new-things clientele.

AMERICAN LOBSTER (Homarus americanus)

(For illustration see Color Plate XVI)

The American Lobster is an edible crustacean found on the coasts of the North Atlantic Ocean and the Mediterranean Sea—on our coast especially from Delaware to Labrador. It inhabits waters from the shore out to the 100-fathom line and is most numerous on the shores of Maine and Nova Scotia. It prefers rocky bottoms, though it may be found in other environments, and usually, though not without exception, leaves the shallower waters during the winter months and finds temperatures more to its requirements beyond the 100-fathom line.

All kinds of animals, both living and dead, and some vegetable matter are pleasing to its appetite. Although dangerous prey to attack, the Lobsters, in spite of their hard shells, powerful claws, and burrowing habits, fall victim to the Cod, the Tautog, the Skate, and the Dogfish, which annually destroy millions of them, particularly the young ones, the egg-bearing females, and the molting adults.

The effect of overfishing for Lobsters shows more in the steady decline in the size of those taken than in the diminution of numbers. The provision of a closed season does not accomplish much, since the female carries her spawn attached to her body for about ten months. Regulations requiring the release of females carrying spawn—"in berry," as that condition is known to the Lobster fishermen—have been made, but are usually ineffective.

The number of eggs produced by a female Lobster varies from 3,000 to 100,000, depending upon the size and age of the individual, maturity being reached in from three to four years. It is believed that it lays only every other year.

The Lobsters are usually caught in traps known as Lobster pots, made of ordinary plastering lath and having a funnel-shaped opening made of tarred netting, permitting easy ingress, but closed against exit. The traps are sunk on Lobster-frequented grounds and baited usually with pieces of stale fish. The European Lobster is nearly always sent to market in the fresh state, while many of those caught in American waters are canned. The European variety seldom reaches a weight of 10 pounds, while those of our shores occasionally weigh as much as 25 pounds. The largest one ever taken, according to the records, weighed 35 pounds.

Photograph Courtesy of Canadian Government Motion Picture Bureau

PREPARING HERRING TO BE SMOKED: LOCKEPORT, NOVA SCOTIA

No fish contributes so largely to the support of the human race as the common Herring. It is so important and abundant in the fisheries that it is often called "King Herring." It swims closely packed, in enormous schools, often over areas of 6 to 20 square miles, and the annual catch in American and European waters is nearly two billion pounds. In Maine, quantities of young Herring are canned as sardines. One authority has estimated the annual destruction of Herring by man as upward of eleven billion fish, or seven fish to each person in the world.

A SHORT VISIT TO WALES

Historic Associations and Scenic Beauties Contend for Interest in the Little Land Behind the Hills

By Ralph A. Graves

Author of "Fearful Famines of the Past," "The Romance of Geneva," etc., in the National Geographic Magazine

BOTH scenically and historically, the Principality of Wales is one of the most alluring regions of the British Isles, yet comparatively few of the thousands of American tourists who make the transatlantic voyage include it in their itinerary. It is accessible, the hotel accommodations are admirable, the people hospitable, the highways irreproachable, the summer climate delightful. But the average American traveler takes one glance at his guidebook or at the tourist-agency folder and decides to go to the English Lakes district, to Scotland, to the "Lorna Doone" country, or—Paris.

He lacks the courage to wrestle with such place names as Bettws-y-Coed, Bodelwyddan, Dwygyfylchi, Clwyd, Llandudno, Pwllheli, and Pen-y-Gwryd.

BUYING ONE'S TICKET IS A PROBLEM

If the traveler goes to a railway station to get his transportation, he cannot tell where he wishes to go. If a ticket agent in a tourist office asks whether he would prefer to go by this route or by that, with stop-over privileges here or there, the sounds convey to him no impression of any of the places he may have read about.

He may have equipped himself in advance by studying some "easy rule for pronouncing Welsh names," such as "To pronounce *Ll,* place the tip of the tongue back of the upper front teeth and blow through the side of the mouth; *Ch* is a strong guttural having no equivalent in English, but is a prolonged *k* (ach); *W* is *oo,* as in *good.*" But if ever he imagined he could remember such rules, he forgets their practical application the moment he hears *glin-div'r-doo-i,* meaning Glyndyfrdwy. It's so much simpler to go elsewhere!

Consequently, at tourist agencies the Welsh window never has a waiting line, and few clerks are able to give one advice as to where to go, how long to stay, and how to come back.

It is a pity, for within this little principality, having an area considerably smaller than New Jersey, one will find the loftiest peak and the finest mountain scenery of England and Wales; the loveliest waterfalls of the British Isles; beaches which rival those of Atlantic City, Deauville, or Brighton; streams that teem with trout and other fish dear to the heart of the angler; footpaths through vale and forest which cannot be surpassed in the Tyrol or the Pyrenees; and the gray ruins of tessellated towers and frowning bastions, each of which has its own tale to tell of romantic adventure and of daring in the Dark or the Middle Ages, when English kings battled ceaselessly to curb turbulent Welsh princes whose chief end and aim in life was warfare.

The courageous visitor who steels himself to suffer the slings and arrows of outrageous orthography and even more outrageous pronunciation of proper names, and decides upon a week-end in Wales faces three instead of the proverbial two horns of a dilemma. Shall he visit Northern Wales, Middle Wales, or Southern Wales?

Each section has its definite appeal and each its peculiarities. The guidebook—or more properly books, for some of the best are issued in three volumes, one for each section—does not help in reaching a decision.

We shall let chance decide and go to that section from which David Lloyd George, the Empire's war-time prime minister, hails. We find it is Northern Wales.

A GLIMPSE OF CHESTER

How fortunate, for the gateway to this region is that unique city of western England, Chester, with its mellow old cathedral, its fine walls, and its other-days atmosphere.

By taking an early morning train from London, the hurried visitor is enabled to have a sufficient stop-over in the border

THE TWO-STORY SIDEWALKS IN BRIDGE STREET, CHESTER

These continuous galleries or arcades occupy the place of the front rooms on the first floors of the houses on four of the main streets of the ancient city which is the gateway to Northern Wales. The ceiling of the ground floor forms the upper sidewalk (see text, page 639). The fourteenth century walls of Chester, following the lines of the ancient Roman foundations, are nearly two miles in circumference, and the paved footpath, from four to six feet wide at the top, affords a charming promenade.

Photograph by Robert Reid

THE SYCHNANT PASS, ON THE ROAD BETWEEN PENMAENMAWR AND CONWAY

The pass attains an elevation of 500 feet, almost directly from the sea. Rising from Penmaenmawr is a summit once crowned by the ancient British fort of Dinas Penmaen, immortalized by Bulwer-Lytton in "Harold, the Last of the Saxon Kings," as the scene of the betrayal of Griffith ap Llewelyn.

Photograph by Robert Reid

WELSH HAYMAKERS ON A HILLSIDE FARM

On the steep fields of farms in hilly districts it is impossible to use horses for mowing the hay. The younger farmer is being assisted by his father-in-law during the harvest season.

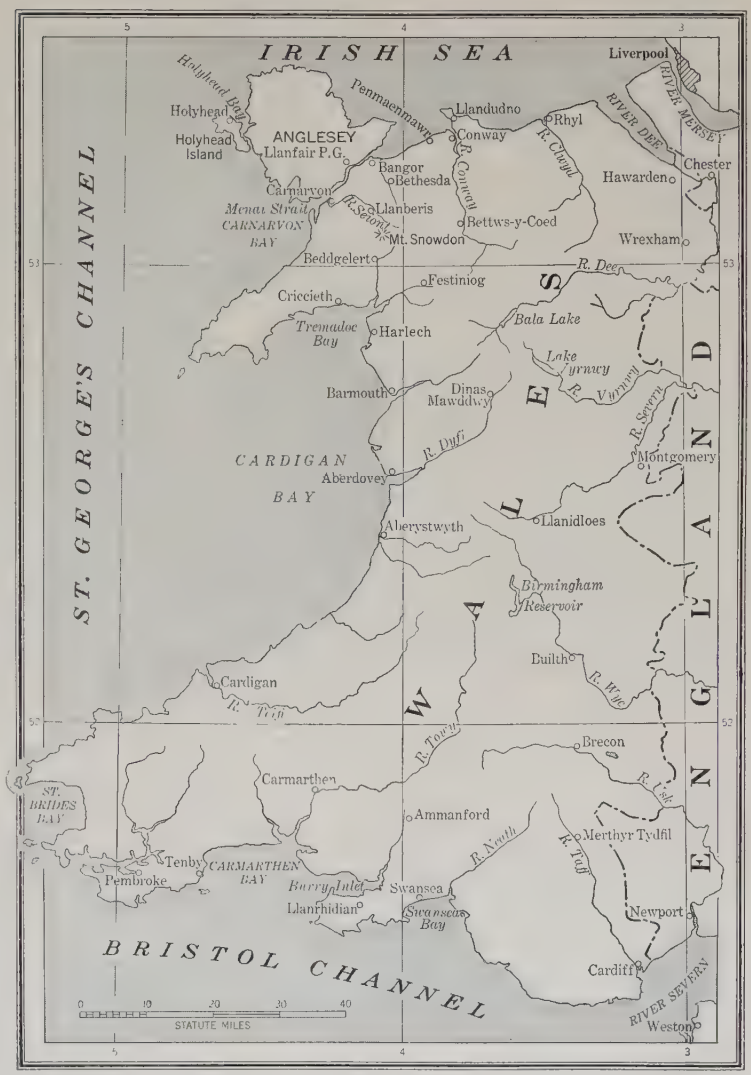
town to convince him that he must return for a longer visit.

Chicagoans might see demonstrated here in Chester how their proposed two-story sidewalks for the Loop District will work. This ancient city's famous Rows are four streets with sidewalks in two tiers. The shopper goes from store to store along a sort of open arcade, and at the end of a block, if he is on the second-story sidewalk, he descends by a stairway to the street level, crosses to the next block, and pursues his survey of show-windows (see illustration, page 636). Mystery surrounds the origin of these Rows.

Here, too, even if he has only an hour to spare, the tourist will visit the sixteenth-century "Stanley Palace" — palace only in historic associations. It was here that for sixteen weeks the seventh Earl of Derby (forebear of the present owner of the building and holder of the title) was concealed under the ceiling from Cromwell's men. But all in vain: a false servant thwarted a resourceful wife, and Stanley lost his head.

Just off the drawing-room in this quaint old structure, built thirty years before the Pilgrim Fathers reached America, are two windowless cubby-holes, where the guests were wont to sit in the glow of smoking rushlights and converse after the 9-o'clock curfew bell had sounded for all lights out.

But, regardless of Chester's compelling charm, we cannot linger on the threshold of Wales if we would enjoy its hospitality.



Drawn by James M. Darley

A SKETCH MAP OF WALES

With a population of 2,206,000, the principality is 750 square miles smaller than New Jersey.

GLADSTONE'S HOME AND THE SANDS OF DEE

Crossing the River Dee, our train enters Wales, bound for Carnarvon, 69 miles distant by way of Rhyl, Conway, and Bangor.

Within a mile or two of the railway line, and just six miles southwest of Chester, rises Hawarden Castle, famous in Welsh history and as the residence of

FISHERMEN OF CONWAY

During the summer season fishermen augment their incomes by renting small pleasure boats to visitors. At one time Conway was famous for its pearl fisheries, which are mentioned in Spenser's "Faërie Queene," and one of the Conway pearls is said to be in the British Crown.

Photographs by Robert Reid

MILKING TIME: WALES IS FAMOUS FOR ITS BLACK CATTLE

The great herds of goats which in medieval times swarmed on the Welsh hills have given way to the small mountain sheep which produce the excellent Welsh mutton.

SALMON FISHERMEN AND THEIR CORACLES ON THE BANKS OF THE RIVER TOWY

This type of boat is a survival of the skin-covered coracle used by the Britons 2,000 years ago. The frame, of beech and ash twigs interlaced, is covered with a stout sheet of canvas soaked in tar and pitch. Note the clubs in leather pockets on the seats, used for killing salmon when caught.

Photographs by A. W. Cutler

TAKING HIS FIRST LESSON IN THE NAVIGATION OF A CORACLE

Until a boy has become proficient in the art of handling this ancient craft of Wales, he is tied to it with a rope, so that if the boat turns turtle he can hang on to it till assistance arrives.

Photograph by Ralph A. Graves

THE INTERIOR OF CARNARVON CASTLE AS SEEN FROM THE EAGLE TOWER

It was in a small room of the Eagle Tower that Edward II, the first English Prince of Wales, is reputed to have been born (see text, page 644). The present heir to the British throne was invested here, with great historic ceremony, in 1911.

Queen Victoria's great "Home Rule" premier, Gladstone.

On our right hand, for many miles stretch those fatal Sands of Dee across which Charles Kingsley's Mary went to "call the cattle home," and never home came she.

We shall not stop at Rhyl, the first considerable Welsh seaside resort. It has its attractive marine drive and promenade, its pavilions and its piers—the sort of diversions demanded by its 100,000 annual visitors—but nothing of special interest to commend it over any of a score of our own watering places.

Nor shall we stop just now at Conway. Let us hold that in reserve for a Monday-morning visit, after our quiet Sunday in Llandudno, on our return journey.

Loyal Welshmen will look upon it as an affront if we fail to leave the train at Bangor and pay a hurried visit to their famous suspension bridge over the Menai Strait, "a marvel of strength and elegance," with a length of 580 feet from pier to pier and 1,710 feet over all from the mainland to the island of Anglesey. It must be admitted that this structure is surpassed by the Brooklyn Bridge, the suspension bridge across the Danube at Budapest, and others; but when it was opened, a hundred years ago, it was regarded as a notable engineering triumph, materially reducing the time between Dublin and London via coach and fast packet, and obviating the crossing of the Strait by ferry—a perilous undertaking at certain tides.

There is a second bridge across the Menai Strait now—the Britannia tubular bridge, which accommodates the express trains running to Holyhead, port for mail steamers to Dublin, only 60 miles across St. George's Channel.

CARNARVON, MOST HISTORIC TOWN OF WALES

Resuming our journey after reading the warning sign that "Persons are prohibited from joining trains without first obtaining tickets", we arrive late in the afternoon at Carnarvon, a community

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THE GORSEDD CIRCLE, IN THE CASTLE GROUNDS AT ABERYSTWYTH

The Eisteddfod (see text, page 644) is opened by ceremonies of the Gorsedd, within the Bardic Circle, according to ancient custom. Aberystwyth, often called the Brighton of Wales, is the most important resort on Cardigan Bay. It is the home of the National Library and the seat of the senior college of the University of Wales, the other constituent colleges being located at Bangor and Cardiff.

which concentrates more history in smaller space than any other town in Wales.

Depositing our baggage at a low-spreading hotel, once a coaching inn, near the station, and receiving from the proprietor a tiny motor guidebook which gives the grade, mile by mile, of all the highways of Northern Wales, we meander up the main street in the direction indicated by an obliging Carnarvonite.

Turning a corner, we are suddenly face to face with one of the finest castles in Great Britain. Built entirely of hewn stone, the imposing structure stands on the peninsula formed where the River Seiont flows into the Menai Strait.

Every room in the great building has its legend, each dear to the stentorian guide, whose indignant protest to an incredulous tourist greets us down the full length of the corridor which once gave entrance to the noble banquet hall 100 feet long and 45 feet wide.

LEGENDARY BIRTHPLACE OF FIRST ENGLISH PRINCE OF WALES

There are those who would take the "Oh!" out of all history, leaving it devoid of color and sentiment. They have been busy with Carnarvon Castle, trying to rob it of its most cherished tradition; but, since the present bearer of the title thought there was sufficient basis for the story to warrant his investiture in this castle in 1911, we shall prefer to accept the legend that here was born the first English Prince of Wales, 639 years ago.

The story is a familiar one.

During the reign of Edward I, the Welsh rose against the English, declaring that they would never acknowledge

allegiance to any prince "but of their own nation and language and of an unblamable life."

Edward brought his army to Wales and put down the rebellion led by Llewelyn the Last. He then commissioned his famous architect, Henry de Elreton, to build castles at Conway, Carnarvon, Criccieth, and Harlech, as strongholds from which in future he might hold his turbulent subjects in check.

During his long stay in Wales, Edward's queen, Eleanor, visited him at Carnarvon, and in a small room, barely twelve by eight feet, in the so-called Eagle Tower of the unfinished castle, he who was to be Edward II was born.

Tradition further says that the king, half in jest and half in earnest, presented the baby to the Welsh people as "a native-born prince of unblamable life who could speak no word of English." A few years later (1301) this son was formally created "Prince of Wales," and from that day to this the recognized heir to the English throne has borne that title.

One of the dungeons shown to the visitor is that in which the notorious Roundhead, William Prynne, was confined, having been sentenced to "lose the *remainder* of his ears, to be branded on the cheeks, pay a fine of £5,000, and be imprisoned in Carnarvon Castle for life."

From the towers of this stronghold, which one historian declares was built within a year by the forced labor of Welsh peasants and with money wrung from the country's chieftains, we can survey the scenes of many of the most stirring episodes of Welsh history — a panorama of two thousand years, from the time when Roman legions occupied the site as the city of Segontium to the present day, symbolized by a bronze statue of David Lloyd George standing in the shadow of the castle walls.

Incidentally, it is Carnarvon that has returned Lloyd George to Parliament for more than thirty years, and he enjoys the honorary distinction of being Constable of the castle. The War Premier's home is not in this town, however, but in Criccieth, 15 miles to the south. Contrary to popular belief, the Welsh statesman was born neither in Carnarvon nor Criccieth, but in Birmingham, over on the English side, where his parents were residing at the time, his father being a school-teacher. He spent his childhood and youth, however, in "the little land behind the hills," as he has characterized his country.

THE EISTEDDFODAU, MOST DISTINCTIVE OF WELSH FESTIVALS

A short distance from the castle is Twt Hill, below which is an immense pavilion capable of seating 8,000 persons, and yet its capacity is greatly overtaxed whenever an Eisteddfod is held in Carnarvon.

The Eisteddfodau are among the most distinctive and inspiring institutions preserved for sixteen hundred years by the Welsh. They are the famous festivals of song, music, and poetry where Welsh bards participate in contests comparable only to those of the ancient Greeks, except that here the competition is exclusively intellectual and artistic, with no place for athletics on the program.

The national Eisteddfod has been held annually since 1819, in Northern Wales and Southern Wales alternately.

A pretty story has survived concerning an Eisteddfod held in the sixth century, on the banks of the Conway, when a prince of Northern Wales, in order to prove the superiority of vocal music over instrumental, offered a prize to the contestants who would swim across the river and then compete. Those bards who had harps found their strings wet when they reached the scene of the competition, but the vocalists were in perfect form and won easily.

One of the spectacular feats at an Eisteddfod is the "pennillion" singing, in which the poets compose their songs after the harpist has begun his melody. Each poet in turn sings his verse, beginning two measures behind the harpist, but ending on the same measure. The contestant who is able to improvise worthy verses longest wins one of the most cherished honors of the festival.

Such contests have made the Welsh a nation of singers, and the rivalry between the various sections is such that even underground the coal miners are said to rehearse their choruses for the coming Eisteddfod. And Dr. Daniel Protheroe, of Chicago (born in Ystradgynlais), the Welsh composer and conductor, is authority for the statement that immediately after the Armistice, when the Allies were

Photograph by Robert Reid

ON HER WAY TO THE COCKLE SANDS

The women carry their riddles (used in separating the shellfish from the sand) on their heads, sometimes walking alongside the donkeys and sometimes riding on them. The donkeys have no bridles and only a sack for a saddle.

Photograph by Robert Reid

MENAI SUSPENSION BRIDGE, ONCE A MARVEL OF ENGINEERING

There are two carriageways, each 12 feet wide, and a footpath between them, 4 feet wide. The total length of the bridge is 1,710 feet and the distance between the points of suspension is 580 feet (see text, page 642).

Photograph by Robert Reid

THE CASTLE OF CRICCIETH, BUILT ON A HIGH ROCK JUTTING OUT INTO THE SEA

Criccieth, on the southern slope of the Carnarvonshire Peninsula, commands a splendid view of Cardigan Bay and has a fine stretch of sandy beach. On a hill to the north of the main street of the town is Bryn Awelon, a modern timbered house, the residence of David Lloyd George.

Photograph by A. W. Cutler

MOUNT SNOWDON, THE MOST DISTANT PEAK ON THE RIGHT, SEEN FROM LLANBERIS

Through the near-by Pass of Llanberis runs the finest carriage mountain road in Wales. The water to the left of the picture is Llanberis Lake.

Photograph by Robert Reid

CONWAY CASTLE AND THE SUSPENSION BRIDGE OVER THE CONWAY RIVER

The town of Conway is surrounded by a high wall 12 feet thick and fully a mile in circumference. The wall is pierced by four gates of Moorish aspect and is crowned by 21 towers. In its southeastern corner are the magnificent remains of Conway Castle (see text, page 666). The walls are from 12 to 15 feet thick, with eight large towers, on four of which are turrets. There were two entrances to the castle—one by a narrow flight of steps leading to the river, and the other, the main entrance, by a drawbridge over a deep moat.

Photograph by Robert Reid

EAST GATE AND GUILDHALL, CARNARVON, CAPITAL OF NORTHERN WALES

The town is the center of a large agricultural district. Some of the streets are very narrow and quaint, reminding one of medieval times. Large numbers of motor busses ply from the castle square to the foot of Mount Snowdon, and also to the surrounding villages. The ancient walls of the town, flanked with round towers, are well preserved.

Photograph by Robert Reid

TWO WOMEN IN WELSH COSTUME WINDING YARN IN A GARDEN AT CARNARVON

The national costume is seldom seen nowadays, except at the great festivals of song and poetry—the Eisteddfodau (see text, page 644); but the old language and the folk tales, many generations old, are sedulously preserved in the Welsh hills and remote valleys. For the women who cling to ancient fashions there are special hatters to make the tall, glossy beavers.

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AN AIRPLANE VIEW OF CARDIFF, THE METROPOLIS OF WALES

Cardiff's growth from a village of less than 2,000 inhabitants in 1801 to a city of 200,000 is due to its geographical position, as the natural outlet for the South Wales coal field. To-day it is the largest coal-exporting port in the world.

Photograph by Robert Reid

COCKLE GATHERERS

The donkeys are most willing workers. The road between Llanrhidian, South Wales, and Llanmorlais, a village to the northeast, runs through what is known as Cockleland, as attested by the mounds of cockle shells and the women at work gathering the edible shellfish, which are taken in great quantities from the estuary of the Burry River.

Photograph by Robert Reid

RHUDDLAN CASTLE, THREE MILES INLAND FROM RHYL

This stronghold was built by a prince of Northern Wales early in the eleventh century, and was rebuilt by Edward I in 1277. It was here that the English king succeeded in inducing the Welsh chieftains to accept as their prince the baby born in Carnarvon Castle (see text, page 644).

Photograph by A. W. Cutler

THE OPENING OF THE WADING SEASON AT TENBY, SOUTH WALES

The old Welsh name for Tenby means "a precipice of fishes." This popular winter and summer watering place is superbly situated on a limestone promontory with a sandy bay on each side. An important settlement of Flemish cloth-makers was established here early in the twelfth century.

Photograph by Robert Reid

WELSH SHEEP IN MONTGOMERYSHIRE

Many of the people know no English, and Welsh is everywhere the favorite tongue of the people in this county. The hardy Welsh ponies are bred among the hills and the sheep are famous. Note the numerous small fields into which the land is divided—a characteristic of a large part of Wales.

Photograph by Robert Reid

CARNARVON CASTLE, ONE OF THE FINEST SPECIMENS OF A MEDIEVAL FORTRESS IN BRITAIN

The castle overlooking the River Seiont covers an area of almost three acres. Large sums were expended in renovating it prior to the ceremonies attendant upon the investiture of the Prince of Wales here in 1911, and it is now in a fine state of preservation (see also text, page 643, and illustration, page 642).

Photograph by Robert Reid

A COTTAGE OF NORTHERN WALES

In the villages the rents are very low; a nice cottage can be leased for 60 cents a week.

Photograph by Robert Reid

"LA MARGUERITE" ARRIVING AT MENAI BRIDGE

During the summer season, there are regular sailings between Liverpool and Welsh watering places, and in fine weather the pleasure steamers are usually crowded.

Photograph by Robert Reid

A GIRL OF SNOWDONIA IN WELSH COSTUME

This girl is employed by an enterprising merchant to sell his wares at a tourist resort near Mount Snowdon. Her costume is almost as much out of date as that of Priscilla would be in New England to-day.

celebrating the end of the war, the Welsh soldiers decided almost spontaneously upon a Festival of Song, which was held on every battle field where there was a Welsh contingent in the line.

Illustrative of the importance which music plays in the life of the Welshman, there was a war-time anecdote which told of eight Britons who were found in a dugout after a 12-hour bombardment. The two Irishmen were still fighting, the two Scotchmen were holding a debate, the Englishmen had not yet been introduced, but the two Welshmen were busy organizing an Oratorio Society.

At a recent Eisteddfod held in the village of Ammanford, South Wales, there were more than 18,000 spectators, including Welshmen who had returned for the occasion from the four corners of the world — from the United States, from Canada, from Australia and New Zealand, from India, Patagonia, and even the Fiji Islands.

The choruses, solos, and contests in poetry, history, and criticism last for several days and continue from early morning until late at night.

THE EISTEDDFOD PLAYS THE RÔLE OF A PEOPLE'S UNIVERSITY

The object of these great gatherings is to perpetuate the Welsh language, popularize Welsh literature, and afford the people the cultural advantages of good music. How effective they have been in maintaining the ancient language may be judged from the fact that Cymric is in every-day use on all railway time-tables, in shops, in churches, and other public places; for, although the principality was peacefully absorbed into the realm of the Tudor sovereigns four centuries ago, eight per cent of the people of Wales and Monmouthshire speak only Welsh, while nearly a third of the inhabitants speak both Welsh and English.

In Scotland, less than one-half of one per cent of the people speak their ancient tongue exclusively, and less than four per cent speak both Gaelic and English. In Ireland, despite the intense nationalism of its people, less than four per cent speak Irish (Gaelic) exclusively, and only one-eighth of the inhabitants speak both Irish and English.

It is only a few miles' ride by train or char-à-bancs from Carnarvon to Llanberis, where the ascent of Mount Snowdon may be made by footpath or by a rack-and-pinion railway.

This peak simply must be scaled by every visitor to Wales. What do you think of the view from Snowdon? is the first question the returned tourist is asked, and if he has no answer he might as well have made a trip to Washington without going up in the Washington Monument, seeing the Capitol and the Library of Congress, and making a pilgrimage to Mount Vernon.

THE ASCENT OF MOUNT SNOWDON

Those of us who have no penchant for time-consuming mountain-climbing—and who of us has when only a week-end is allotted to such a fascinating country as Wales?—will utilize the tiny railway, provided there is a sufficient number of tourists of similar inclinations to induce the conductor-engineer to make the trip. Of course, if anyone is a spendthrift he can buy eight tickets for himself, and the puffing little engine will begin its complaining push-push journey. More than an hour is required to reach the top—3,560 feet above sea-level.

The upward climb affords a succession of magnificent pictures of billowing hills, of tiny lakes tucked in their pockets, of occasional glimpses of the Menai Strait or Carnarvon Bay, of slate quarries, clinging perilously to the mountain side, and of the silently enveloping waves of cloud and mist through which radiant shafts of sunlight pierce from time to time to give color to the adjacent slopes, with their bits of pasture here and there, on which flocks of sheep are forever clip-clipping the luxuriant herbage.

But as for the clear-weather view from the summit! That must be left to the guidebook author who maintains that "the outlines of the Cumberland Mountains, the Isle of Man, the Wicklow Mountains in Ireland, and Holyhead Mountain on the coast of South Anglesey, 32 miles distant, can be seen." On my visits to the summit, only the contiguous peaks could be discerned through the alternately lifting and lowering mists.

It is true that the guidebooks caution

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READY FOR THE CLIMB UP MOUNT SNOWDON

The rack-and-pinion mountain tramroad from Llanberis to the summit, 4¾ miles long, was begun in 1894 and completed in less than three years (see text, page 661).

the visitor against these mists and storm clouds and suggest guarding against disappointment by taking the following precaution: "Stand upon the doorstep of the Free Library at Llanberis, and by looking between the two chimney stacks of the house immediately beyond the chapel opposite, you can see if Snowdon is clear."

All of which is true; but one cannot stand on the doorstep while making the railway journey. And what freaks Snowdon weather can play during the 70 minutes required for the ascent! Nothing is more exasperating than to start from Llanberis with Snowdon shining clear in the sun, reach the top in a heavy mist or in a downpour, then descend only to find the mountain's profile again sharply chiseled against the sky—nothing more exasperating except to have it happen twice or three times (see page 428).

But Snowdon is not a unique mountain in this respect. Those other show heights, Rigi-Kulm, above the Lake of Lucerne, and Mount Tamalpais, in California, have a habit of playing the same shabby trick upon the sight-seer.

If Snowdon were in the United States it would receive scant notice, in so far as its elevation is concerned. Who, for example, thinks of Mount Greylock, in the Berkshires, as a towering peak? And yet the two are within a few feet of the same height. Twenty-five of our States have within their borders loftier summits than this premier Welsh peak. Four Snowdons could be piled one upon another and Mount Whitney, in California, still could look down upon the topmost.

Measured in historic association and scenic charm, however, Snowdon holds its own with far nobler heights. It has been rightly called the Parnassus of the British Isles.

LEGEND SAYS AMERICA'S DISCOVERER CAME FROM SNOWDON'S FOOTHILLS

One of the folk tales of Snowdonia, which can be taken for what it is worth, is intimately connected with America. It was among these foothills, so the story goes, that Madoc, son of the Prince of Gwynedd, tiring of wrangling with his brothers, set forth, some time during the

Photograph by A. W. Cutler

ON THE CRICCIETH BEACH AT LOW TIDE

At high tide these sands are covered by eight feet of water.

twelfth century, to find a new land. With a hardy crew, he sailed for months across the western seas and finally came to America.

There are some Welsh philologists who profess to have found Cymric words in the old Mexican tongue, and tradition says that the Spaniards brought back a story to the effect that the Montezumas claimed descent from strangers who came in ships from the east. All of which provides sufficient material to bolster up the old wives' tales that a Welsh prince and his followers preceded Columbus to America by more than three centuries.

A far more substantial link between America and Wales, however, is the fact that the Mount Snowdon region was the ancestral home of Thomas Jefferson.

IN THE HAUNTS OF MERLIN THE MAGICIAN

Returning to Carnarvon from Llanberis by motor bus, we pass within sight of a wooded eminence known as Dinas Emrys. It was here that that doughty old Briton king Vortigern retired to build an impregnable tower as a shelter for his old age. But however high the walls were raised by day, they would tumble down at night. The old king consulted his advisers, who claimed that the walls would never stand until they had been sprinkled with the blood of a child who had never had a father. It's a long story, but the point of it is that Merlin proved to be the desired prodigy, born of a virgin and a demon.

When Merlin appeared before Vortigern for sacrifice, he told the king that the foundations of his tower were being laid over a subterranean lake in which dwelt two dragons, and that every night when they turned over, the walls crumbled. The lake was drained, the dragons found and slain, and Merlin was spared to live for many, many years and figure in countless Arthurian legends which have been immortalized for us by Malory and Tennyson.

Railroad schedules and motor-bus routes apparently are especially designed to meet the whims of all tourists in Northern Wales. One can go almost anywhere, at any time, usually with less than a half-hour wait at railway station or bus-stop.

Photograph by Robert Reid

THE LARGEST SLATE QUARRIES IN THE WORLD, NEAR BETHESDA, FIVE MILES FROM BANGOR

The photograph shows only a small section of the terraces (see text, page 669). There are literally mountains of slate in Wales.

And, whichever way one decides to proceed, he feels that some good genius directed his choice, for waterfalls and meadows, rolling landscapes and flashing seascapes, gladden the short journey from historic spot to delightful watering place.

TO LLANDUDNO, QUEEN OF WELSH WATERING PLACES

Our journey takes us next to Llandudno, appropriately styled the queen of Welsh watering places.

The town itself is built around a vast semicircle of firm sandy beach, with the ends of the crescent tipped with two towering masses of rock, the Great Orme's Head and the Little Orme. Neither Nice, nor Deauville, nor Biarritz, nor Scheveningen, nor any of the much-vaunted middle-Europe bathing resorts on the shores of Hungary's Lake Balaton, has a situation comparable to this magnificent watering place.

And the Welsh people have made excellent use of the opportunities which Nature presented. A concrete "boardwalk" wider than New York's Broadway follows the graceful curve of the beach for more than a mile and a half; countless bathhouses on wheels follow the tide back and forth, being drawn up and down the sands by horses; veritable droves of donkeys are provided for the children's rides when they tire of digging in the sand; a pier jutting out into the bay for half a mile is the scene of daily concerts and dances, while along its full length are booths of fortune-tellers, catch-penny venders, and other allurements which attract those who delight in such diversions while on holiday.

AN INCOMPARABLE CLIFF HIGHWAY

But it is the incomparable Marine Drive, chiseled out of the solid rock of Great Orme's Head, winding between sea and sky, midway along the precipitous cliff, which brings distinction to Llandudno over all other resorts. No similar stretch of the Corniche Drive along the Riviera can excel it in grandeur.

There are many, many spots which lure

Photograph by Robert Reid

FISHING IN THE VALLEY OF THE DYFI, NEAR DINAS MAWDDWY

The angler in Wales frequently is required to pay a license for the privilege of pursuing his sport. In the vicinity of Dinas Mawddwy, for example, the trout license for the season is only one shilling; but if the fisherman wishes to take salmon he pays a shilling a day, five shillings a week, or one pound for the season.

the visitor: Happy Valley, nestling in a hollow of the Great Orme, presented to the town by Lord Mostyn as a memorial of the Queen Victoria Jubilee; the Church of Our Saviour, in whose grounds Lewis Carroll (Dr. Charles L. Dodgson), author of "Alice in Wonderland," used to romp with his youthful friends and where he received inspiration for his matchless works of imagination from Alice, the daughter of Dean Liddell, whose residence was near by; and St. Tudno's Church, a medieval structure occupying the site of the cell of St. Tudno, a hermit of the seventh century who gave his name to Llandudno (*llan* meaning church).

NO CONTINENTAL SUNDAY AT LLANDUDNO

In contrast to the fashionable European watering places, Llandudno achieves a puritanical, not to say saintly, calm on Sunday. There is no music on the pier, motor-bus offices are closed, all inquiry booths suspend operations, it is impossible to make railway reservations, and even the ticket offices on this day are opened for only ten minutes prior to the arrival of trains. One is compelled to rest on the Day of Rest in Wales. Incidentally, it is well to remind the week-ender that he must not defer his trip to Mount Snowdon until Sunday, for the mountain railway is not operated on that day.

One can play golf, it is true; but even on the links there is a unique rule which forbids the employment of caddies on Sunday! This may impress the average golfer as not much of a hardship, but he should be reminded that on Llandudno's North Wales Golf Course, which overlooks the Irish Sea, there are, if memory, fortified by an atrocious score card, serves aright, only four greens which can be seen from their driving tees. The rest are blind, and the stranger drives usually into the teeth of a near-gale, willy-nilly, over a tossing sea of sand dunes, guided only by a direction flag.

Monday morning must provide a bonanza of lost balls for the caddies.

There is an interesting colony of summer residents in Llandudno which the

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LLANDUDNO AND GREAT ORME'S HEAD AS SEEN FROM LITTLE ORME (SEE TEXT, PAGE 664).

tourist rarely sees and of which he seldom hears. They are Moroccan merchant princes and their entourages.

These princes reside in England half the year, purchasing cotton goods at Manchester for the consumption of the Mohammedan world. In summer they move their families to Llandudno, leasing apartments in the many "boarding residences," as the smaller hotels are called, where they dwell in more or less seclusion. Their secretaries commute 85 miles to Manchester twice a week to transact the necessary business during the dull season.

CONWAY CASTLE AND THE HOUSE OF QUEEN ELIZABETH AND LEICESTER

The summer sight-seer enjoys the advantage of long days in this part of Wales, and in July a newspaper can be read in the open as late as 10:30 in the evening.

These twilights are apt to deceive one, and many a tourist stopping in Llandudno defers his visit to adjacent Conway until its great castle is closed for the day.

Conway Castle, like that at Carnarvon, has Welsh history graven on every stone. It, too, was built by Edward I (see page 644), but it has not been restored, as was the birthplace of the first English Prince of Wales. Its dismantled appearance is attributed to an Earl of Conway in the time of Charles II, who, under the pretense of the requirements of His Majesty's service, had all the iron, timber, and lead in the building torn out and shipped to Ireland, where he expected to sell it.

This act of vandalism had its own reward; the ship bearing the material was wrecked and the contents swallowed up in the Irish Sea.

Of close secondary interest to the castle is Plas Mawr ("the Great Mansion"), a picturesque sixteenth-century house, in which Queen Elizabeth and her favorite, the Earl of Leicester, are said to have spent many happy days. It is now the headquarters of the Royal Cambrian Academy of Art. Of course, it has its haunted chamber, known as the Lantern Room, and some one with a passion for figures has ascertained that there are 365 windows and 52 doors in the building,

Photograph by Robert Reid

OVERLOOKING LLANDUDNO FROM THE GREAT ORME

The most popular seaside resort in Northern Wales is thronged with visitors during July and August. The main portion of the town lies along a crescent-shaped bay, flanked by two prominent headlands, the Great and Little Orme. A wide and spacious promenade, provided with numerous seats and shelters, skirts the bay, and the firm, clean sands make an ideal playground for children. Note the individual bathhouses, which are shifted back and forth across the beach, as needed by the bathers (see text, page 664).

Photograph by Robert Reid

DONKEYS FOR THE CHILDREN ON THE BEACH AT LLANDUDNO

corresponding to the days and the weeks of the year.

Every visitor to Conway pays a pilgrimage to the little Church of St. Mary, a part of which was once a Cistercian abbey founded in the twelfth century. Inside is a tombstone which records the fact that "Nicholas Hookes, of Conway, Gent., who was the forty-first child of his father, William Hookes, Esq., by Alice, his wife, and who was himself the father of twenty-seven children, died on March 20th, 1637."

In the adjoining churchyard is a tombstone, protected from relic-hunters by an iron screen, which is reputed to mark the graves of John and Jane, brother and sister of the little Maid of Conway who insisted to the poet Wordsworth that "We Are Seven."

ANOTHER ASPECT OF WALES

We may wander for many week-ends through Northern Wales without exhausting the list of quaint villages and their contiguous scenic beauties.

If we would look at the Wales of Industry, we must go to the south and devote more than the few fleeting hours of the casual traveler to the study of its social problems and its commercial importance.

The three largest towns of the principality—Cardiff, with 200,000 inhabitants; Swansea, with 157,000, and Merthyr Tydfil, with 80,000—are situated in Glamorganshire, a county occupying only one-ninth the country's area, but where more than half the total population is congested.

This is the great coal-mining district of Wales, where it is estimated that one person in every six (including men, women, and children) works underground, producing from 47,000,000 to 57,000,000 tons of coal annually (chiefly bituminous steam coal)—one-fifth of the annual supply of the United Kingdom. In addition, this is the only important anthracite region in Europe.

South Wales is also the copper-mining district and the great center for the tin-plate industry of Great Britain. Of the 82 Welsh tin-plate mills, 65 are concentrated within a radius of 18 miles of Swansea.

There is one celebrated industrial plant, however, which the Northern Wales tourist may visit by motor bus from Llandudno. It is the Penrhyn slate quarries,

Photograph by A. W. Cutler

A WELSH COCKLE WOMAN WAITING FOR BUSINESS AT CARMARTHEN, SOUTH WALES

The cockle, which measures in its shell from one to two inches in breadth, is regularly eaten by the poorer classes of England and Wales. Cockle fishing consists of simply raking the mollusks from the sand when the tide is out.

near Bethesda. These are said to be the largest quarries in the world, and have at times employed as many as 3,000 workmen, producing 360 tons of slate a day. The quarries resemble a vast amphitheater with tiers 50 feet in height (see page 664).

WITCH'S HAT DISAPPEARS, BUT THE GELERT LEGEND GOES ON FOREVER

One may—and usually does—wander through the towns of Wales for days or weeks without at any time encountering a single individual wearing the "witch's hat" which most of us think of as "typically Welsh" before we visit the country. In fact, the only survivals of the national costume seen nowadays are those worn at the Eisteddfodau (see page 644) and those displayed in museums or as "fancy dress" (see pages 651 and 660).

But one never goes to Wales or reads a book on Wales without encountering two stand-bys of the centuries—the story of the hound of Beddgelert, and a certain place name on the island of Anglesey; and although this does not purport to be an orthodox Wales travel article, subjects of such ancient and honorable lineage as these cannot be overlooked.

Beddgelert is 13 miles by motor bus from Carnarvon. The town itself is the center for many charming walks, but our visit is for the purpose of dropping a supposititious tear on the apocryphal grave of Gelert, a dog belonging to one of the Llewelyn clan. His master, you will recall, returned home one day to find the dog covered with blood and the cradle of his child overturned. In rage and grief, Llewelyn instantly slew the dog.

But when the cradle was righted the child was found unharmed, with a dead wolf at its side. Llewelyn, realizing too late that he owed his son's life to the dog, buried the animal and placed a stone over his grave, where the credulous and incredulous alike come to pay their tribute to this prototype of "mankind's best friend."

The second Welsh stand-by is not legendary but geographical. It is the first village on the Anglesey shore, four

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A SCENE AT THE OPENING OF THE WELSH NATIONAL FESTIVAL OF SONG, MUSIC, AND POETRY AT ABERYSTWYTH

The Gorsedd, or governing body of the Eisteddfod, robed in white, blue, or green, according to the degree of membership, forms a circle about the Arch Druid. The Arch Druid is here shown standing upon the stone from which he delivers his annual address. Beside him is a candidate who has been presented for membership in the Gorsedd.

Photograph by Robert Reid

HARLECH CASTLE, ON THE OPPOSITE SIDE OF THE BAY FROM CRICCIETH

This magnificent fortress, on a cliff overhanging a stretch of marshy land, was built by Edward I in the thirteenth century (see text, page 644). It was made famous in 1468. Dafydd ap Einion, a soldier of spectacular bravery attached to the House of Lancaster, when called upon to surrender the castle to the Earl of Pembroke, replied by messenger: "Tell your leader that some years ago I held a castle in France for the king so long that all the old women in Wales talked of it; and now I intend to hold this Welsh castle until all the old women of France shall talk of it." The hardships suffered by his garrison, which was finally starved into submission, are said to have inspired the famous national song, "March of the Men of Harlech." A fine view of the Snowdon hills can be had from its walls.

Photograph from Aerofilms, Limited

AN AIRPLANE VIEW OF "THE MUMBLES," NEAR SWANSEA, SOUTH WALES

The Mumbles Head lighthouse is famous in Welsh maritime lore on account of the heroism of its "Grace Darlings," the Sisters Ace, daughters of the lightkeeper. The curious name "Mumbles" is said to be derived from the moaning, mumbling sound of the waves, or from a corruption of "mammals," having reference to the rounded appearance of the islets.

Photograph by Robert Reid

A GROUP OF WELSH SCHOOL CHILDREN MANIFESTING INTEREST IN THE GEOGRAPHIC PHOTOGRAPHER

Photograph by Maynard Owen Williams

FRENCH SCHOOL CHILDREN WITH AMERICAN FLAGS AT THE DEDICATION OF THE CANTIGNY MEMORIAL (SEE OPPOSITE PAGE)

The dedication exercises took place on Bastille Day, July 14, 1923, the great French national holiday when usually only the Tricolor is displayed. But as a special honor to America, the Stars and Stripes were carried by the children when the National Geographic Society presented the memorial fountain and water-supply system to the historic little French village.

miles from Bangor. Practical mapmakers irreverently label it briefly "Llanfairpwllgwyngyll," or even merely "Llanfair P. G." (see sketch map, page 639), but its unabridged, honest-to-Cymric name is *Llanfairpwllgwyngyllgogerychwyrndrobwllllandysiliogogogoch,* which means "Church of St. Mary in a hollow of white hazel, near to a rapid whirlpool and to St. Tysilio's Church, near to a red cave."

The street urchins of Llan-etc., reap a considerable harvest from tourists, who pay a penny to have the name pronounced, and, considering the length of service rendered, the fee would seem to be within reason.

But to him who has once reveled in the delights of week-ending in Wales, not even the pronunciation of Llan-etc., and its sister villages, can quell the longing to repeat the experience.

THE NATIONAL GEOGRAPHIC SOCIETY'S MEMORIAL TO AMERICAN TROOPS

Fountain and Water Supply System Presented to Historic French Town of Cantigny, Where Our Overseas Soldiers Won Their First Victory in the World War

TO BUNKER HILL and Gettysburg the World War added another holy place of American history—Cantigny.

At this little white stone village of France, American overseas troops, fighting as a unit, first exhibited their valor and received their first baptism of German fire.

Members of the National Geographic Society have the honor of bestowing upon this Old World shrine the first memorial gift commemorating an event and a place which will loom ever larger in the perspective of history.

On Cantigny's tiny hill, near Montdidier, some twenty miles southeast of Amiens,* this memorial was tendered to the village, in the name of The Society, in the presence of high French officials, on France's beloved Bastille Day, July 14, 1923, by Dr. J. Howard Gore, a member of The Society's Board of Trustees and chairman of the Memorial Committee.

The character of the gift was determined by the Cantigny Town Council and consists of a complete water-supply system for the village, including a capacious artesian well and pump, a handsome central fountain, a large pond, and accessory water pipes and outlets to all parts of the village.

Upon the white marble fountain is a tablet bearing, in English and in French, this inscription:

Here at Cantigny
on May 28, 1918

The American Forces Won
Their First Victory
in the World War

In Memory of a Comradeship
then reaffirmed
The National Geographic Society
of North America
Dedicates This Fountain

Many official delegations attended the ceremonies, including a color guard from the American Legion, but among the most picturesque groups that gathered there were French school children bearing American flags (see page 674).

In explanation of the circumstances leading to the presentation of the memorial, Dr. Gore, in his address of presentation, said:

"The National Geographic Society, with a membership of 800,000, under the leadership of its resourceful and energetic

* See map, "Western Theater of War," Special Supplement in colors, 26¼ x 31 inches, NATIONAL GEOGRAPHIC MAGAZINE, May, 1918.

Photograph by Maynard Owen Williams

THE COLOR GUARD FROM THE AMERICAN LEGION

president, Dr. Gilbert Grosvenor, was active in many lines of endeavor to aid the Allied cause and to contribute to the welfare and comfort of our soldiers at home and abroad. At the close of the war The Society, finding itself with an unexpended balance of a fund, decided to utilize it in erecting a memorial to our participation in the great conflict."

The fund Dr. Gore referred to was that voluntarily contributed by The Society's members to establish and equip National Geographic Society wards in American Military Hospital No. 1, at Neuilly, France. The Society's trustees decided that the remainder of this fund, following the closing of the hospital, no longer needed to minister to the men, could best be used to memorialize them.

Cantigny was chosen as the recipient for this gift upon the advice of General Pershing, who in his official report had called the Cantigny engagement "a brilliant action, which demonstrated our fighting qualities under extreme battle conditions."

It was the First American Division that first went over the top at Cantigny. War records since have disclosed that the German General Staff had ordered that the heart be taken out of the Americans, at any cost, when they first showed up as a unit anywhere on the fighting front.

Therefore an order, commonplace enough in itself, for the Americans to iron out the salient at Cantigny converted what would have been a skirmish into a terrific struggle, during which the Germans rallied thousands of men and hurled 19,000 shells into the tiny town.

Even after Americans took Cantigny, they had to hold it against six counter-attacks.

AMERICA'S ACHIEVEMENT AT CANTIGNY

An impartial and authoritative English estimate of what the American soldiers did at Cantigny says:

"Cantigny, small but proud, on its green eminence, overlooking with a mouth of fire the whole countryside, was to be taken. Never did men rise so eagerly out of trenches to go forward than those Americans.

"Through gas, through a cloud of machine-gun bullets, following close behind

Photograph by Maynard Owen Williams

THE NATIONAL GEOGRAPHIC SOCIETY'S MEMORIAL FOUNTAIN AT CANTIGNY, SCENE OF AMERICA'S FIRST VICTORY IN THE WORLD WAR

The panel at the right bears the dedicatory inscription in French; on the left panel is the English (see text, page 675). The fountain was designed and constructed by M. Alexandre Marcel, architect.

Photograph by Maynard Owen Williams

THOSE WHO PARTICIPATED IN THE DEDICATION EXERCISES

At the extreme left is Col. Francis E. Drake, first departmental commander of continental Europe of the American Legion. Standing between M. Emery, Prefect of the Somme (the officer with the beard), and the Mayor of Cantigny is Dr. J. Howard Gore, Chairman of the Memorial Committee, who represented the Board of Trustees and members of the National Geographic Society, at the dedication exercises. After the mayor come General Biochut, M. Duffan, Under Prefect of Montdidier, and M. G. Grandidier, Secretary of the Société de Géographie, of France.

their barrage, they steadily ascended the slopes of the village and sheltered themselves in the cemetery when the village was theirs. The village was the first ever captured by American troops in Europe, and the lesson that the Germans learned was the first they had received from the youth of America."

Cantigny of to-day typifies the heroism of her own citizens in peace, as she once signalized the courage of the American troops.

Naturally, the "green eminence" was devastated—swept of not only every habitation, but every semblance of being a habitable place. As Dr. Gore said, "They not only pulverized the town but they blew away the dust."

The surviving citizens of Cantigny hesitated to rebuild their homes because of the lack of water in this dry district, and it was not until the National Geographic Society offered a memorial water supply that a reconstruction of this heroic and historic town was undertaken.

The dramatic moment of the Bastille Day ceremony took place after the mayor of Cantigny had formally accepted the gift of The Society and "The Star Spangled Banner" and the "Marseillaise" uncovered the heads of the crowd.

And its significance, perhaps, was best summed up when a rosy-cheeked schoolgirl in blue presented Dr. Gore with a bouquet of countryside flowers and a bystander explained:

"It is the water your Society provided which makes our hillsides bloom."